

REPORT

PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER

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1 October 1969 – 31 December 1969

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Thus is the eighth quarterly report in a series prepared for the Office of Technology Utilization, National Aeronautics and Space Administration (NASA). It presents the results of three months of research on technology transfer conducted by the Industrial Economics Division of the University of Denver Research Institute (DRI).

Material presented in this report was gathered and analyzed as a part of the Project for the Analysis of Technology Transfer (PATT). PATT was established in November 1967 to provide a better understanding of the technology transfer process by examining nonspace applications of NASA-developed technology. To achieve this goal PATT has the following objectives:

- (1) To operate a Technology Transfer Data Bank consisting primarily of information on the characteristics of users of NASA's Tech Brief-Technical Support Package Program
- (2) To document actual and potential cases of transfer of space-related technology to secondary uses
- (3) To suggest for NASA's consideration programs or mechanisms to improve the effectiveness and to reduce the costs of NASA's technology transfer activities. This objective is partially met by the accomplishment of specific research tasks dealing with various aspects of the Technology Utilization Program
- (4) To maintain contact with sources of technology, with channels of technological communication, and with users of technology in order to stay in touch with developments affecting performance of these participants in the technology transfer process
- (5) To maintain awareness in past and on-going research contributions to the understanding of the technology transfer process, and to contribute to this knowledge base

This report summarizes progress made during the period October 1 – December 31, 1969, in achieving these objectives, and briefly discusses future activities. It builds on data presented in previous PATT reports as well as on results of other DRI technology transfer research.

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30 January 1970

REPORT HIGHLIGHTS

Analysis of fourth quarter TSP request letters and questionnaires showed that

- Nearly three-fourths of the requesters were engineers or managers
- Over two-thirds were employed by manufacturing firms
- Approximately one-third worked for firms employing 10,000 persons or more
- Three-fifths of the requesters worked for organizations located in the Northeast and North Central sections of the United States
- Electrical TSP's were most frequently requested
- Two-fifths of the requests were for TSP's originating at the Marshall Space Flight Center (Section II)

First returns on the revised TSP questionnaire produced several findings related to TSP applications and evaluations

- Approximately one-fourth of the applications involved attempts to solve specific technical problems
- Nearly two-thirds of the respondents cited current awareness benefits, while 30 percent identified economically related benefits
- TSP ratings (high and low) were related strongly to users' abilities to identify benefits derived from TSP applications.
- Life Sciences and Materials TSP's fared substantially better than all others in terms of ratings given, benefits cited, and overall request frequency (Section III)

A study of factors related to TSP request frequency showed that Tech Briefs are likely to have frequently requested TSP's when

- Unique technical characteristics are emphasized
- Highly refined nonexperimental technology is reported
- Tech Brief titles refer to handbooks or manuals
- The availability of TSP's is announced in professional or trade publications (Section IV)

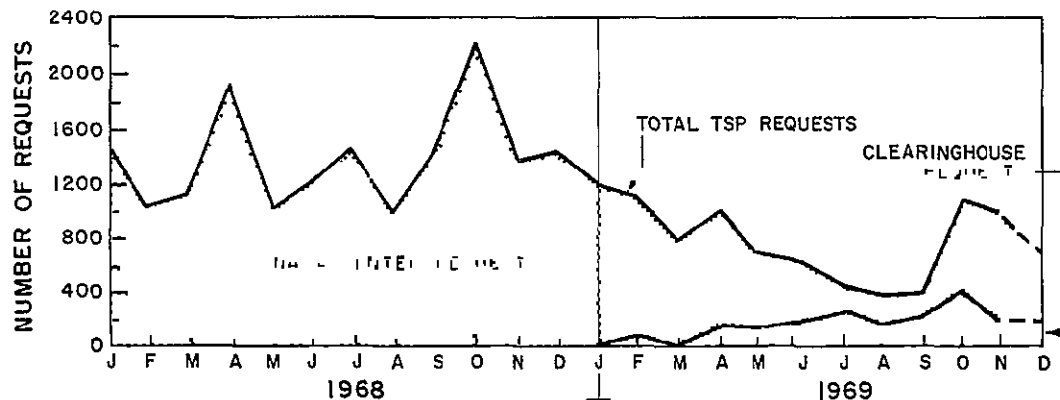
SECTION I. PATT FOURTH QUARTER 1969 RESEARCH ACTIVITIES

PATT research activities conducted from October through December 1969 are reviewed in this section.

Tech Brief-Technical Support Package Program Analysis

Approximately 60 percent of PATT research during the quarter dealt with operations of the Tech Brief-Technical Support Package (TSP) program. Information about this NASA program was collected from three sources TSP request letters, TSP questionnaires and TSP telephone interviews. By December 31, the Data Bank contained information on a total of 33,609 TSP request letters and 9,005 TSP questionnaires

TSP requests For the first time in 1969, an upward trend in TSP request frequency developed during the fourth quarter. The increase, shown in the following figure, resembles to some extent the increase which occurred during the same period one year ago



Altogether, 2,760 TSP requests, or an average of 920 per month, were made during the final three months of 1969. This contrasted sharply with the 508 requests per month during the third quarter. At the same time, however, the absolute number of TSP requests during the quarter and throughout 1969 remained far below comparable periods of one year ago. Perhaps the most significant factor affecting the 1969 TSP request rate was the decision, effective in January 1969, to distribute

all newly published TSP's through the Clearinghouse for Federal Scientific and Technical Information. Persons wanting TSP's published in 1969 were required to pay \$3.00 for each document requested from the Clearinghouse. Those published before 1969 could still be obtained at no charge from the originating NASA field center.

As the demand for TSP's published prior to 1969 declined, the number of 1969 requests also declined. The trend in TSP requests almost immediately turned upward in October, however, shortly after NASA Headquarters personnel decided to distribute without charge some new TSP's through originating field centers.

As shown in the figure on the previous page, approximately four-fifths of the TSP requests during the fourth quarter were sent to NASA field centers, the remaining 20 percent were sent to the Clearinghouse for Federal Scientific and Technical Information. Detailed information concerning fourth quarter TSP requesters is presented in Section II.

TSP applications and user evaluations. The recently revised TSP questionnaire was used exclusively for the first time during the fourth quarter. 1,428 questionnaires were mailed out with 1,305 (81.7 percent) completed, returned, and entered into the Transfer Data Bank. The new questionnaire provides more specific information than previous questionnaires about who ordered TSP's, how they learned about their availability, what TSP applications they made, what benefits resulted, what difficulties were encountered, and how different users evaluated TSP's. Initial results of questionnaire data analysis are summarized in Sections II and III.

Telephone interviews. While TSP request letters and questionnaires were used to provide general information on TSP applications, 122 telephone interviews were conducted with persons who appeared to have made specific applications of NASA-generated technology. The following table shows all but five of the interviews were with persons using TSP's. Appendix A contains summaries of the more important interviews.

NASA Technology Transfer Programs	Technical or Financial Results Reported	
	Did or Might Occur	Did Not and Will Not Occur
TSP's involved	72	45
TSP's not involved	5	0
Totals	77	45

TSP request frequency study. A study designed to examine certain factors associated with TSP request frequency was concluded during the reporting period. Five factors were identified, four of which were found to be related significantly to TSP request frequency. Results of the study, along with alternative approaches to increasing Tech Brief program effectiveness, are presented in Section IV.

Other PATT Activities

PATT personnel conducted a number of other tasks related to the analysis of technology transfer. The tasks summarized below were aimed at examining different ways NASA-developed technologies are disseminated, applied and evaluated.

Technology transfer seminar. Work began on the preparation of a report summarizing major results of a technology transfer seminar held at Snowmass-at-Aspen, Colorado, on September 26-28, 1969. The report, entitled "The Environment and the Action in Technology Transfer 1970 - 1980," is scheduled for publication in April 1970.

Technology transfer library and bibliography. At the close of the quarter, over 1,500 documents had been catalogued in the PATT library. In addition, work continued on a major revision of the technology transfer bibliography, which is scheduled for publication in May 1970.

Technology transfer example files. Files containing technology transfer cases involving the space program were given to PATT by NASA Headquarters early in the fourth quarter. Those files provide a basis for broadening the scope of PATT since they allow for the investigation of transfers not involving the Tech Brief-TSP program. Late in the quarter, a number of cases drawn from the files were prepared for possible use in congressional testimony. At the same time, work began on the development of a system for analyzing and integrating the contents of the files.

NASA-related news clippings. Early in November, PATT assumed responsibility for monitoring the news clipping service to which NASA subscribes. 1969 clippings were grouped into four categories: references to TU publications (e.g., Tech Briefs, TSP's), references to TU Division programs (RDC's, COSMIC, BATeams, TATeams) and TU activities of various NASA centers, references to both actual and potential

4 RESEARCH ACTIVITIES

transfers of NASA-developed technology, references not satisfying the first three categories (e g , professional journal and general news magazine clippings). Materials drawn from the clippings are being used to build the technology transfer example files.

SECTION II FOURTH QUARTER TECHNICAL SUPPORT PACKAGE REQUESTS

This section summarizes PATT fourth quarter research findings concerning TSP requesters and technical areas of interest to them. The usefulness of knowing such characteristics is shown in Section III where substantial variations in TSP uses, benefits, and ratings are identified with different user groups and TSP subject areas.

Data were derived from 3,168 TSP request letters and 947 TSP questionnaires processed during the 1969 fourth quarter. When useful for comparative purposes, data drawn from other time periods also are presented.

TSP Requesters

Occupations. The majority (73 percent) of requesters responding to the questionnaire identified themselves as engineers or managers. Less than ten percent described themselves as scientists. Approximately four percent called themselves technicians, and three percent were librarians. Other requesters included lawyers, teachers, and students.

Educational backgrounds. Over two-fifths (43 percent) of the requesters reported having bachelors degrees, another 27 percent masters degrees, 11 percent doctoral degrees, and 19 percent had other types of educational credentials.

Standard Industrial Classification (SIC) of requesters' organizations. Over two-thirds (67 percent) of the fourth quarter TSP requests came from persons working in manufacturing firms. Eleven percent were employed in educational, consulting, and other service types of organizations. Another 11 percent worked in government (principally Federal) organizations. Six percent did not report employment (e.g., students, persons giving private addresses). Five percent worked for various types of commercial (nonmanufacturing) firms.

Size of requesters' organizations. More than one-fourth (29 percent) of the requesters worked in organizations employing 10,000 persons or more, almost one-half (46 percent) worked in organizations with 500 employees or more.

Requesters' locations. Well over half (58 percent) of the requests during the fourth quarter came from persons living in the Northeast and North Central sections of the United States. The same proportion occurred during the last three months of 1968.

Sources of awareness. Far more TSP requesters used printed materials than used interpersonal contacts to learn about the availability of specific TSP's. Seventy-one percent of the questionnaire respondents said they learned about particular TSP's through some kind of publication. Almost one-half (45 percent) of those using publications cited NASA Tech Briefs as source, the remainder indicated learning about specific TSP's through trade or professional journals. Well over one-fourth (29 percent) of the requesters learned about the availability of particular TSP's through personal contacts.

TSP Subject Areas

Sharp differences were found between 1969 and 1968 fourth quarter requesters in terms of certain TSP subject areas of interest. The following table shows that Electrical TSP's predominated in the 1969 fourth quarter, whereas nearly one-half (48 percent) of the 1968 fourth quarter TSP's were in the Mechanical category.

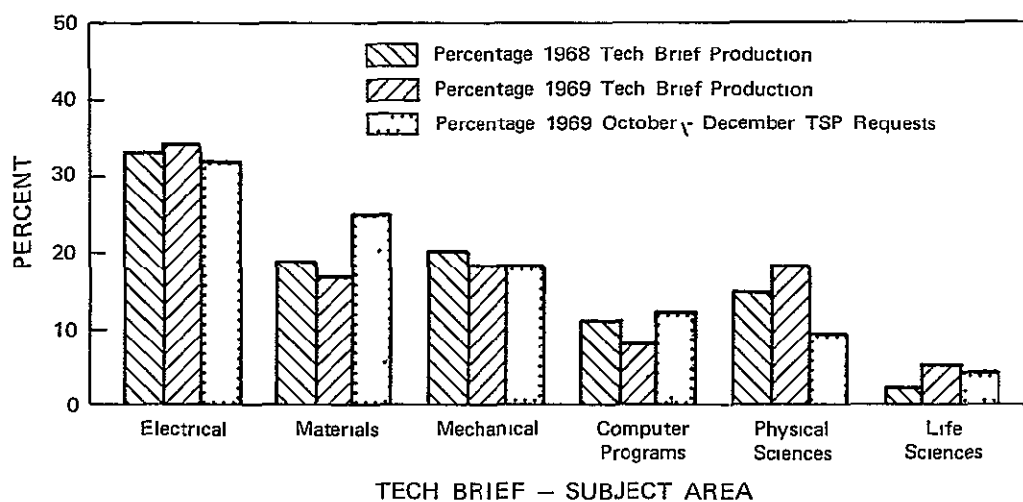
TSP Subject Area	<u>Fourth Quarter Requests</u>	
	1969	1968
Electrical (Electronic)	32%	31%
Materials (Chemistry)	25	10
Mechanical	18	48
Physical Sciences	9	7
Computer Programs	12	3
Life Sciences	<u>4</u>	<u>1</u>
Totals	100%	100%

The differences observed between the two quarters may be explained partially by the fact that the popularity of specific TSP's differs considerably during the course of a year. The table on the following page, which compares 1969 and 1968 TSP request frequencies on a full

year basis, indicates that the quarterly fluctuations noted above evened out over the period of a year.

TSP Subject Area	Yearly TSP Requests	
	1969 (N=8,807)	1968 (N=20,476)
Electrical	31%	41%
Materials	32	28
Mechanical	22	19
Physical Sciences	7	8
Computer Programs	5	2
Life Sciences	3	2
Totals	100%	100%

Data in the following table demonstrate that 1969 fourth quarter TSP request frequency closely paralleled 1969 and 1968 Tech Brief production per subject area. The only exceptions involved (1) Materials (Chemistry) and Computer Programs Tech Briefs which received proportionately more TSP requests than the number of Tech Briefs produced per category, and (2) Physical Sciences Tech Briefs which received proportionately fewer requests than expected on the basis of Tech Brief production.



Frequently Requested TSP's

The request frequency per subject area category is affected substantially by the presence of a few frequently requested TSP's.

8 TSP REQUESTS

During the 1969 fourth quarter, for example, three TSP's in the Materials subject area accounted for 41 percent of all Materials TSP requests.

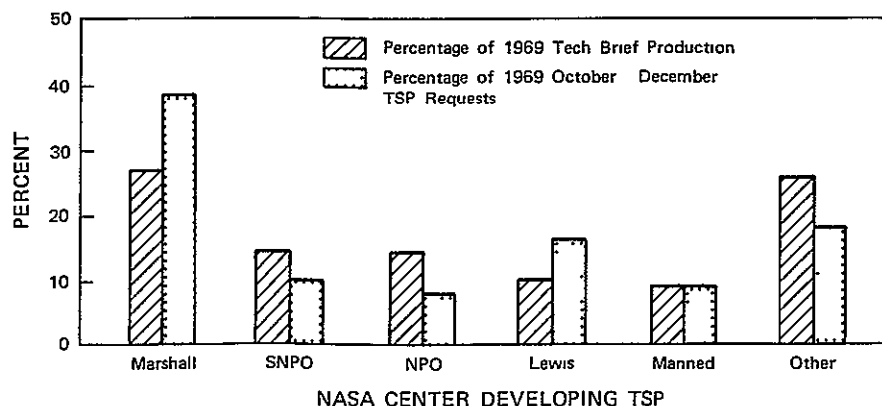
The most frequently requested Technical Support Package during the fourth quarter of 1969 was one which was developed for the Marshall Space Flight Center, "Contamination Control Handbook." The ten TSP's requested most frequently during the period are shown on the following page.

NASA Centers Developing TSP's

Nearly two-fifths (39 percent) of the 1969 fourth quarter requests were for TSP's developed at the Marshall Space Flight Center.

NASA Center Developing TSP	Fourth Quarter Requests	
	1969 (N=3,168)	1968 (N=4,454)
Marshall Space Flight Center	39%	37%
Lewis Research Center	16	11
Space Nuclear Propulsion Office	10	15
Manned Spacecraft Center	9	13
NASA Pasadena Office (JPL)	8	3
Ames Research Center	6	12
Goddard Space Flight Center	5	5
Other	7	4
Totals	100%	100%

The observed TSP request pattern can be explained partially by comparing request frequencies with the TSP production of each center as shown in the following table.



1969 FOURTH QUARTER
TEN MOST FREQUENTLY REQUESTED TSP's

TSP Number	Request Frequency	Originating Center	Subject Area	Title
68-10392	160	Marshall	Materials	Contamination Control Handbook
67-10348	138	SNPO	Computer Programs	Computerized Parts List Systems Coordinates Engineering Releases, Parts Control, and Manufacturing Planning
67-10568	133	SNPO	Computer Programs	Graphic Visualization of Program Performance Aids Management Review
68-10574	71	Marshall	Physical Sciences	Training Manual on Optical Alignment Instruments
69-10072	61	Lewis	Materials	Refractory-Metal Compound Impregnation of Polytetrafluorethylene
68-10069	54	Goddard	Electrical	Principles of Optical-Data Processing Techniques
69-10118	48	Lewis	Materials	New Rapid-Curing Stable Polyimide Polymers with High Temperature Strength and Thermal Stability
69-10055	46	Marshall	Materials	Thermal Expansion Properties of Aerospace Materials
69-10268	41	Lewis	Life Sciences	Health Hazards of Ultrafine Metal and Oxide Powders
67-10361	39	Kennedy	Electrical	Pocket-Size Manual Tape Reader Device Aids Computer Tape Checking
All Others	<u>2,377</u>			
TOTAL	3,168			

TSP request frequencies vary, to some extent, according to the number of Tech Briefs produced by each field center. Certain centers differ greatly from all others, however, in terms of their ratio of TSP request frequency to Tech Brief production. Some, such as Lewis and Marshall, regularly receive substantially more requests compared to Tech Brief production than any other centers. The major reason for this appears to be that they have produced just a few Tech Briefs with very popular TSP's. For example, Lewis and Marshall each originated three of the ten most frequently requested TSP's during the fourth quarter

SECTION III. FOURTH QUARTER TSP APPLICATIONS AND RATINGS

New insights were gained during the 1969 fourth quarter concerning the applications and evaluations made of information in Technical Support Packages (TSP's). The insights resulted, in part, from the use of a recently revised TSP questionnaire. The questionnaire was designed to better determine who uses TSP's, what TSP applications are made,, what technical and financial benefits result from such applications, how users evaluate TSP's, and how TSP applications, benefits, and ratings vary according to different user and subject area characteristics.

In the last quarter of 1969, 1,428 TSP questionnaires were mailed to requesters, 1,167 (81.7 percent) were completed and returned. Tabulations from a sample of 947 of the returned questionnaires, are summarized in Appendix B. The purpose of this section is to present results of the initial cross tabulations of data related to TSP applications (question 6), beneficial results (question 8), and evaluations (question 10)

TSP Applications

For this analysis, two general types of TSP applications were examined. The first dealt with attempts to solve specific technical problems. Approximately one-fourth (27 percent) of the respondents said they used TSP's for this purpose. Engineers and managers were about equally likely to specify this application.

The second general type of TSP application involved requesters' efforts to keep abreast of developments in fields of their interest. Scientists were almost twice as likely as engineers or managers to indicate they used TSP's in this manner. Librarians and managers were roughly three times more likely than scientists and engineers to simply pass TSP's along to someone else for possible use.

TSP Benefits

Three major categories of benefits were identified in the questionnaire: current awareness, stimulation of basic or applied research, and economic results. Nearly two-thirds (65 percent) of the respondents stated that TSP's helped them keep abreast of developments in their fields of interest. Economically related results (including product development or improvements, processing development or improvements,

monetary or time savings, sales increases) accounted for approximately 30 percent of the benefits identified. Nine percent of the respondents indicated TSP's were useful in stimulating basic or applied research.

One out of eight respondents stated they had derived no benefits from the TSP's they had received. Requesters in smaller organizations (usually those employing fewer than 500 persons) were twice as likely as those in larger organizations to state they had not benefitted. In terms of technical subject area, respondents using Physical Sciences TSP's were most likely (21.2 percent of the time) to state no benefits had resulted, however, respondents using Materials (Chemistry) TSP's were least likely (6.5 percent of the time) to indicate they had not benefitted. TSP's in other technical subject areas were close to the average 12.5 percent "no benefit" response average

Persons using TSP's primarily for "current awareness" purposes were twice as likely as those using them for other purposes to state they did, in fact, learn something from the documents. Those using TSP's to help solve specific technical problems were far more likely than others to indicate that they had developed or improved processing techniques, improved existing products, or saved money or time.

Respondents citing libraries as the source through which they learned about specific TSP's were much more likely than those using other sources to indicate they had received current awareness benefits. Persons learning about particular TSP's from people outside their organizations were far more likely than others to indicate they received "other" benefits (e.g., assisting in article preparation, developing teaching aids).

TSP Ratings

A measure of overall TSP quality was obtained by averaging respondents' TSP evaluations with respect to ten pairs of adjectives (see Question 10, Appendix B). The resulting scores ranged from 5.0 (most positive TSP rating) to 1.0 (most negative TSP rating). The overall average (median) rating fell between 3.7 and 3.8.

TSP ratings were related strongly to the ability of users to identify benefits derived from TSP applications. This is reflected partially in the fact that 25 percent of the respondents citing "no benefits" gave their TSP's above average ratings. By contrast, 84 percent of those

citing cost savings benefits gave their TSP's above average ratings. Sixty-two percent of the respondents indicating TSP's had stimulated basic or applied research gave their documents above average ratings. Only about half (48 percent) of those citing current awareness benefits rated their TSP's above average.

Below average ratings came from respondents learning about the availability of specific TSP's through personal contacts. For example, only 35 percent of the respondents learning of particular TSP's through librarians rated their TSP's above average. Most respondents (71 percent) learned about specific TSP's through publications (almost half of these cited NASA Tech Briefs as source).

In terms of technical subject areas, Life Sciences and Materials (Chemistry) TSP's received above average ratings (61 percent and 54 percent respectively). By contrast, Physical Sciences (Energy Sources) and Computer Programs TSP's rarely were rated above average (36 percent and 33 percent respectively). Data in the following table reveal that Physical Sciences TSP's were consistently low not only in TSP rating, but also in benefits received and popularity.

TSP Subject Area	Percent Rating TSP's Above Average	Percent Citing Some Benefit From Use	Average Number of 1969 TSP Requests Per Tech Brief	Percent of TSP's Produced in 1969
Life Sciences	61	87	10	5
Materials (Chemistry)	54	94	15	17
Mechanical	47	84	7	18
Electrical (Electronic)	41	85	6	34
Physical Sciences (Energy Sources)	36	79	5	18
Computer Programs	33	89	12	8

Life Sciences TSP's fared much better than Physical Sciences TSP's in the dimensions compared above. Thus, although relatively few Life Sciences TSP's were produced, many TSP's were requested, and users tended to appreciate the information they received.

SECTION IV. SOME FACTORS ASSOCIATED WITH TSP REQUEST FREQUENCY

The number of requests for Technical Support Packages varies considerably. Some TSP's are requested several hundred times each, while others are rarely or never requested. The study summarized in this section was designed to explore certain hypotheses concerning the relationships of Tech Brief contents and editorial styles to TSP request frequency. In addition, the research examined ways request frequency might be affected when the availability of TSP's is announced in professional or trade publications. A knowledge of relationships between and among such factors presumably could be of use in building indicators of the transfer effectiveness of different Technical Support Packages.

Procedures

A sample of Tech Briefs was drawn which included one-fifth (525) of all Tech Briefs issued prior to March 1969. Distributions of sample characteristics by technical subject area, originating NASA center, and TSP request frequency were compared with corresponding distributions of the total Tech Brief file. A one-to-one correspondence between the sample and the population was observed (see Table C-1, Appendix C).

Within the sample of 525 Tech Briefs, ten percent of the Tech Briefs were ignored because they had no associated TSP's. Another five percent were ignored since they involved COSMIC computer programs. Thus, 444 Tech Briefs were analyzed in the study.

High TSP request frequency was defined as 21 requests or more. This definition was based on analysis of TSP request frequency distributions over the six year period examined. Fifty-six (12.6 percent) of the 444 Tech Briefs had high TSP request frequencies.

Findings

- Only five percent of the Tech Briefs even commented on economic benefits or cost considerations in any way. Two of those Tech Briefs had TSP's requested 21 times or more. Because the number of Tech Briefs commenting on economic benefits is so small, no definitive conclusions can be drawn.
- 12.5 percent of the Tech Briefs reported "unique" technical considerations (i.e., presented basic departures from

contemporary problem solutions), and 26.8 percent of those had high TSP request frequencies. By contrast, only ten percent of those not reporting unique technical considerations had high TSP request frequencies. Thus, presenting unique problem solutions in Tech Briefs does appear to be related to high TSP request frequency.

- Tech Briefs were divided into three classes of technological maturity or development: (1) experimental (concept feasibility demonstrated); (2) tested and evaluated (performance characteristics presented but further research needed), or (3) refined (further research not required for adaptation). In the total sample, 28.8 percent of the Tech Briefs were classified as experimental. Only five percent of the experimental Tech Briefs had high TSP request frequencies. Of the 165 refined Tech Briefs, 62.5 percent had high TSP request frequencies. The more mature the technology reported in a Tech Brief, therefore, the more likely the TSP will have a high request frequency.
- Tech Brief titles were examined to determine whether or not reference was made to the availability of a handbook or manual. Only five of the 444 Tech Briefs mentioned these words. Four of the five, however, had frequently requested TSP's. This initial finding appears quite significant. A total review of the Tech Brief file should be undertaken in order to determine how many TSP's are in handbook form.
- Announcing the availability of TSP's in professional or trade publications appears to be associated strongly with high TSP request frequency. User questionnaire responses, and records from NASA field centers provided relevant data. Forty percent of the questionnaire respondents indicated first learning about particular TSP's through secondary publications. Field center data showed that Tech Briefs having secondary publication had twice the probability of having frequently requested TSP's compared to those not so publicized.

TSP Request Frequency As A Success Measure

The analysis of Tech Briefs was designed to isolate factors that frequently requested TSP's hold in common. During the research,

several reservations emerged concerning the use of TSP request frequency as a measure of program impact. The reservations do not imply that request frequency should be dismissed as a success indicator, but only that the reported technology should be examined along with request frequency in order to present a more meaningful picture of Tech Brief-TSP program effectiveness

- Request frequency and economic significance can be negatively correlated. Certain Tech Briefs describing technology of trivial economic significance generate a large number of requests, other Tech Briefs, announcing fundamental and significant technical developments, generate few requests.
- Certain technical developments can only be adapted in two stages. The necessity of an intermediate stage limits the number of TSP requests to those organizations capable of performing the initial transformation.
- Some Tech Briefs are used to announce certain technical innovations that inherently are of interest to a narrow audience. The breadth of this audience is limited by the sophistication of the technology described. The number of TSP requests for this class of technology necessarily will be low.
- Tech Briefs describing design innovation in areas of substantial commercial activity (e g., product redesign) will not generate large numbers of TSP requests. While the restriction of two-stage adaptation is relevant, so also is the fact that the general audience for such technology requires hardware for adoption rather than concepts.

Alternatives For Increasing Program Effectiveness

A number of alternatives for possibly improving various aspects of the program were generated in this study.

- To reduce the cost of program operations, while maintaining the same impact level, certain types of technology can be more closely screened or eliminated. Specifically, greater selectivity could be used in the areas of the physical sciences, and research or measurement techniques.

- To increase program impacts from the existing technical base, reissuance of Tech Briefs using new groupings and new distribution criteria should be considered. This effort could be complemented by reporting successful transfer examples in the revised Tech Briefs.
- To broaden the Tech Brief program, TSP's could be organized and modified so as to provide source books for different technical fields (e.g., vacuum gauge technology, shop practice, circuit design, management tools).
- To better gauge program impacts, the discrepancy between the economic significance of a technical development and TSP request frequency should be explored. One approach might be to correlate patent license agreements with TSP request frequency and to determine how licensees use the technology. Such an analysis should be limited to Tech Briefs requiring two-stage transformations since simpler technologies can be adopted more easily.

APPENDIX A
Reports of Technology Transfer Through the TSP Program
Applications Actually Resulted – Page 19
Applications May Result – Page 107

REPORTS OF TECHNOLOGY TRANSFER

	Applications Actually Resulted	Applications May Result
NEW PRODUCTS	80504856--tube flare gage 90323829--surface contamination monitor 90425330--contamination control 90627815--impact hand tool 90628030--memory core design 91233602--food products	90525706--nondestructive testing 90627782 and 90627857 -- bacteriostatic coating and contamination control 90627811--metallic object detector 90627830--contamination control 90627958--cryogenic adhesive 90628014--respiration monitor 90728542--precision stepping drive 91233604--shock hydrodynamics 91233606--automotive safety device 91233607--battery-powered tools
IMPROVED PRODUCTS	80812760--thermosetting plastic 90224098--contamination control 90526264--heat transfer coefficients 90526334--electrical system components 90526436--heat flux sensor 90526638--integral heat sink module 90627858--contamination control 90627905--vacuum depositions 90627949--nonmetallic materials characteristics 90627950--gas leakage measurement 90628010--anodized circuit boards 90628021--bearing lubricant 90728494--fusion welding 90829338--phonocardiogram simulator	90323669--heat control circuit 90425046--optical-data processing 90628032--magnetic tape friction device
NEW PROCESSES	90627310--inspection criteria for parallel gap soldering 90628149--contamination control 90728246--contamination control	
IMPROVED PROCESSES	80813975--fluid properties handbook 81221368--optical-data processing 90323622--gas leakage measurement 90526614--contamination control 90627642--nondestructive testing manuals 90627837--contamination control 90627847--contamination control 90627850--contamination control 90628008--contamination control 90729236--contamination control	81119065--gear driven indexing table 90121588--radiographic image amplifier panel 90425448--epitaxial deposition process 90526258--contamination control
NEW APPLICATIONS	90627614--nondestructive testing manuals 90627828--electromotive series 90628147--contamination control 90628160--inspection criteria for parallel gap soldering 90728474--welding manual	80814155--nuclear energy shielding 80815001--helmet telemetric system 90121730--digital computer processing 90424838-39--patient monitoring system 90627305--nondestructive testing 91233601--xenon arc lamps
OTHERS	90122408--soldering tool 90627624--nondestructive testing manuals 90627744--nondestructive testing manuals 90627861-62--contamination control and oceanographic charts 90729238--liquid crystals	90627506--contamination control

Case Number 80504856
 (Supersedes Telephone Follow-up of 6/7/68)

A small Gulf Coast valve manufacturer used information received from NASA to design and fabricate an instrument for quality control checking of flared tubes. The go, no-go flared tube gage, developed initially by Kennedy Space Center, is capable of determining the accuracy of a tube flare efficiently and economically. Use of the device by the manufacturer has improved product reliability and reduced quality control costs.

<u>Subject</u>	<u>Technology Source</u>
Anderson, Greenwood Incorporated P O Box 400 Bellaire, Texas 77401 713-668-0631 Contact Frank Pizzitola Quality Control Manager	Kennedy Space Center Tech Brief 66-10537, "Gage Tests Tube Flares Quickly and Accurately"

Anderson, Greenwood, Inc., a small Texas company manufacturing valves, used a TSP to design an instrument for controlling the production quality of flared tubes. The instrument consists of a test cone and a capacitance bridge meter. After developing the instrument, the company contracted with a small Houston machine shop to manufacture it for use in the Anderson, Greenwood plant.

Quality Control Manager Frank Pizzitola said that he spent only an hour reviewing the TSP before putting its contents to practical use. The instrument has been used since then as a regular quality control testing device to check every flared tube made at the plant. Although Mr. Pizzitola could not estimate the monetary savings involved, he reported that the TSP probably saved his company "about two days" of development time. In addition, he stated the new instrument has contributed toward higher product reliability and efficiency while also reducing the number of quality control man-hours required formerly.

Although the company does not regularly receive NASA Tech Briefs, it has ordered NASA documents of interest which were mentioned in trade publications. Tech Brief 66-10537 was mentioned in the March 27, 1967 issue of Metalworking Week. Recently the company ordered and received NASA's "Contamination Control Handbook" (TSP 68-10392) which it

Case Number 80504856 (Cont.)

became aware of through another trade publication article. The handbook is being retained for reference purposes by the Quality Control Department.

RLB/WH: jt
1/19/70

Case Number: 90323829

A design engineer, working for a Midwestern firm, used a Goddard TSP to update company production cleanliness standards. He found the TSP especially useful in developing a photocell meter for verifying quality control standards in the manufacture of mercury switch components.

<u>Subject</u>	<u>Technology Source</u>
Hermaseal Company, Incorporated 1101 Lafayette Street Elkhart, Indiana 46514 219-264-1119 Contact Frank Aitchison Design Engineer	Goddard Space Flight Center Tech Brief 68-10089, "Monitor Senses Amount of Contamination Deposited on Surfaces"

Production and quality control inspectors with Hermaseal were concerned with contamination affecting the operation of company-produced mercury switches. They found a TSP developed for Goddard Space Flight Center useful in solving the problem. Design engineer Frank Aitchison was able to employ the photocell measurement procedure described in the TSP. The procedure enabled him to determine degrees of cleanliness with a simplified photocell test machine. This machine, produced at a cost of \$75.00, has provided all necessary quality control data and has performed satisfactorily. According to Mr. Aitchison, the machine has reduced inspection time by 60 percent, saving three hours with each 1,000 units produced.

HWZ ed
9/16/69

Case Number: 90425330

A small research company in Massachusetts developed a new product after using a TSP to establish contamination control procedures and a clean room environment. With no previous experience in contamination control, the company was able to develop procedures and requirements for the clean room directly from the "Contamination Control Handbook" it received from Marshall Space Flight Center.

<u>Subject</u>	<u>Technology Source</u>
Alfa Inorganics, Incorporated 8 Congress Street Beverly, Massachusetts 01915 617-922-0768 Contact: Bradford Marvin Sales Manager	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

Alfa Inorganics, a subsidiary of Ventron Corporation (a producer of inorganic chemicals), recently developed a new product for use by the electronics industry. Due to the light-sensitive nature of the product and the requirement to prevent cross contamination with other products, it was necessary to establish contamination control procedures.

The contamination control procedures and information regarding the type of clean room required were developed directly from the NASA handbook. Although Sales Manager Bradford Marvin was not able to estimate the benefits derived in terms of dollars, he stated "without the procedures and clean room there would not be a product "

Mr Marvin learned about the Contamination Control Handbook through the publication called Lab Equipment. He said the NASA information was excellent and crucial to the solution of the company's problem

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Case Number 90627815

A Southwestern explosives manufacturer found a TSP helpful in developing a tool for use in part of its operations. The tool, which incorporates technology originating from Marshall Space Flight Center, is being investigated for patent possibilities.

<u>Subject</u>	<u>Technology Source</u>
Jet Research Center, Incorporated P O Box 246 Arlington, Texas 76010 817-275-2864 Contact Mr Reginald L Robinson President	Marshall Space Flight Center Tech Brief 68-10371, "Versatile Impact Hand Tool"

Jet Research Center, Inc., a wholly-owned subsidiary of Halliburton Company, manufactures explosive charges for ordnance and pyrotechnic devices.

Mr Reginald Robinson, Jet Research President, requested detailed information on an improved cartridge-activated impact hand tool developed for Marshall Space Flight Center. The hand tool has the general configuration of a machine the company was developing to perform a mechanical operation employing explosives. Mr. Robinson, who regularly receives Tech Briefs, said his firm used the hand-held operational characteristics and sturdiness of the tool for prototype purposes. The prototype research was considered successful and the firm is seeking patent approval. Since the patent status of the product probably will not be resolved before 1971, Mr Robinson considered other product details, such as sales potential or cost reductions, to be proprietary.

LS ml
1/21/70

Case Number 90628030

A large East Coast manufacturer of communications equipment used NASA-generated technology in its development of a memory device for telephone use. The technology received from NASA was an improved, plated wire, memory word drive line that was developed under contract for Goddard Space Flight Center. The availability of the TSP was quite important in developing the memory device and resulted in monetary and time savings.

<u>Subject</u>	<u>Technology Source</u>
Stromberg-Carlson Corporation 100 Carlson Road Rochester, New York 14603 716-482-2200 Contact Richard Dever Supervisor-Advance Development	Goddard Space Flight Center Tech Brief 66-10617, "Improved Memory Word Line Configuration Allows High Storage Density"

Stromberg-Carlson, a subsidiary of General Dynamics, used NASA-generated technology in its development of a memory device. The device for use in a telephone system has a storage capability of 38,000 bits and uses a single turn word line configuration.

According to Mr. Dever, the TSP described a plated wire-memory word drive line configuration which the company was to use in the memory device. Information on the B-stage epoxy method was also used in its development activities. Mr. Dever said the NASA information was important to developing the memory device. He estimated the TSP saved approximately \$2,000 in development costs and about one month in development time.

Although the memory device is essentially complete, Mr. Dever indicated that further development activities have been stopped and the memory device will not be marketed. Mr. Dever could not give an explanation for this, however, he said part of the decision had to do with the use of the plated wire concept. He expects the company will buy an off-the-shelf memory device for its system.

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12/22/69

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Case Number 91233602

The Pillsbury Company has experienced very satisfactory initial results in its promotion of Space Food Sticks, a product derived from aerospace contract work.

Subject

The Pillsbury Company
608 Second Avenue South
Minneapolis, Minnesota 55402
612-330-4550

Contact Don Belcher
Marketing Manager,
Nutrition Foods

The Pillsbury Company has performed considerable food research during the past eleven years under contracts with the Air Force and NASA. The results of one research effort for the Air Force have been modified for application in consumer food markets, and promotion is now underway.

The new product, Space Food Sticks, grew out of research which developed a high-energy contingency food for use in the Air Force's Manned Orbiting Laboratory program. The contingency food was intended for use under extreme conditions of cabin depressurization that would preclude removal of space suits. The food would have to be inserted through a face-mask orifice requiring specified qualities of hardness, texture and shape. Flavor considerations were of secondary importance, although the nutrition specifications were quite significant.

Don Belcher, Marketing Manager, Nutrition Foods, reported that Pillsbury's development efforts for this food began eleven years ago and have involved over \$1 million. Pillsbury now holds a patent on the production process for this food.

Adaptation of the product for the consumer market required changes to impart desirable flavors to the food. Three flavors - chocolate, caramel, and peanut butter - are now available, and have sold well in testmarkets. Denver was chosen as the initial test market twenty-one months ago. Results of the test marketing have been very promising, in that sales have not leveled off or declined after an initial spurt. This indicates that consumers regard Space Food Sticks as a genuine food, not a novelty or

Case Number 91233602 (Cont)

fad item. Pillsbury has not designed special packaging and promotion for specific narrow markets, such as hunters and mountain climbers. Nevertheless, it appears that consumers are creatively discovering a variety of such uses without Pillsbury's promoting them.

A whole new spectrum of "nutrition foods" has been opened up for Pillsbury by the aerospace food research and marketing success with Space Food Sticks. Considerable future activity in this area is planned by the firm.

Space Food Sticks (in their commercial form) were aboard Apollo 11 and the Lunar Module during the recent flight and landing on the moon.

WH ss
10/23/69

Case Number 80812760

From information contained in a Lewis Research Center document, an Eastern corporation developed an improved thermosetting plastic for use in housing its photocell in a rocket. The NASA information enabled the company to save time and energy in developing an improved product

<u>Subject</u>	<u>Technology Source</u>
Clairex Corporation 1239 Broadway New York, New York 10001 212-684-0940 Contact Jake G. Rabinowitz Engineer	Lewis Research Center Tech Brief 67-10197, "New Class of Thermo- setting Plastics Has Improved Strength, Thermal and Chemical Stability"

Clairex Corporation, a manufacturer of photo conductive cells used in sun attitude control for unmanned rockets in the Centaur and other series, learned that increasing thrust and vibration were causing the housing device for photocells to disintegrate. To improve photocell dependability, a search was initiated for new or improved cements and thermosetting plastics. The TSP was the major input for forty hours of laboratory and engineering experiments to develop a suitable plastic. Company engineer J. G. Rabinowitz stated that the improved product is sold to a missile contractor where the protective assembly for the Clairex photocell is fabricated.

Clairex personnel found the TSP clear and complete. The sources referenced in the TSP were also used and valuable. Rabinowitz estimated that the \$3,000 in time and material invested by Clairex resulted in a savings of research time and effort.

Rabinowitz stated "the document was well worth its acquisition." He sees Tech Briefs on occasion and finds his most frequent exposure to NASA publications through articles and announcements in professional journals.

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10/18/69

Case Number 90224098

An instrument engineer at Newark Air Force Station has raised contamination control standards for preservation of missile guidance units by applying guidelines presented in a Marshall Space Flight Center TSP.

<u>Subject</u>	<u>Technology Source</u>
Newark Air Force Station Newark, Ohio 43055 (AGNIMI) 614-344-2171, Ext 354 Contact Paul P Smongeski Instrument Engineer	Marshall Space Flight Center Tech Brief. 68-10392, "Contamination Control Handbook"

Personnel at Newark Air Force Station perform maintenance, assembly, and storage on inertial guidance instruments for missiles and aircraft. Instrument engineer Paul Smongeski stated that performance and product life of guidance control units are dependent on their being free of contamination and that cleanliness standards are constantly being challenged in the search for improvements.

The technology reported in the "Contamination Control Handbook," particularly that relating to room and workbench conditions, was found to satisfy requirements at Newark for which Mr Smongeski was responsible. He used the TSP as a guide in raising the cleanliness standards in various production areas. Mr Smongeski indicated the photos and charts in the handbook were of special value in the entire improvement effort.

Mr Smongeski could not assign a monetary value to the benefits he identified. He did say, however, that an investment of \$10,000 on new equipment is budgeted with a projected annual savings of \$20,000 in repair, maintenance and replacement with increased equipment reliability. The handbook further contributed to company contamination control efforts when it became the text for the first personnel training program originated within a department at Newark. Mr Smongeski also has found the handbook very useful in presenting reports on the coordinated, improved procedures to higher echelons in the Air Force.

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Case Number 90526264

Empirical equations have been derived to establish heat transfer coefficients for liquid hydrogen turbopumps. The coefficients, described in a TSP, were developed under contract for Marshall Space Flight Center. The West Coast division of a major aerospace corporation used the TSP to reduce the chill-down requirement on hydrogen turbopumps used on Centaur engines and to predict more closely the chill-down requirements by component. The result has been closer control and an increased payload capability.

<u>Subject</u>	<u>Technology Source</u>
General Dynamics Convair Division Kearny Mesa Plant, P.O. Box 1128 San Diego, California 92112 714-277-8900 Contact Robert Eidson Sr. Design Engineer	Marshall Space Flight Center Tech Brief 68-10517, "Heat Transfer Coefficients for Liquid Hydrogen Turbopumps"

The Convair Division of General Dynamics has the requirement to chill hydrogen turbopumps on Centaur engines. The chill-down requirement on the ground is accomplished with liquid helium, but subsequent starts during flight requires the dumping of propellants to accomplish chill-down of the hydrogen turbopumps. The result was a reduction of propellants and payload capability.

Upon receiving the heat transfer coefficients developed for NASA, the company was able to use the information to more closely predict the length of chill-down time required by component. With the closer prediction capability, it has been possible to reduce the amount of propellant dump required during flight to meet chill-down requirements. This capability has resulted in more effective control of chill-down by component and an increased payload capability.

Mr. Eidson stated that the NASA information also will be used in the analysis of chill-down requirements in the future. He noted that it would be particularly significant as the company looks at advance vehicle designs using multiple start hydrogen engines.

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Case Number 90526334

The Marine Branch of a major aerospace corporation used NASA information in its update design of a control system. The TSP on standards for compatibility of printed circuit and component lead materials was developed under contract for Marshall Space Flight Center. Although the NASA information was only moderately important to solving the problems required in updating the control system, it did contribute toward selection of materials used in the system.

<u>Subject</u>	<u>Technology Source</u>
The Boeing Company Aerospace Division Marine Branch Seattle, Washington 98124 206-654-5860 Contact: Marion Bishop Research Engineer	Marshall Space Flight Center Tech Brief 68-10310, "Standards for Compatibility of Printed Circuit and Component Lead Materials"

The Marine Branch of the Boeing Company recently updated one of its control systems used in hydrofoil design. The Control System is an analog system which uses gyros and is tied into an analog computer. The system operates the hydraulic valves on the actuators in Boeing's hydrofoil design.

Boeing engineer Marion Bishop said the Marshall TSP provided useful information on materials selection and transfer molding. He described the TSP as "moderately important" in solving the total problem since it contributed to an improved control system design. Although Mr. Bishop could not estimate the monetary savings resulting from the use of the TSP, he stated that savings did occur.

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Case Number 90526436

A radiant heating control manufacturer has modified the design of a heat flux sensor originally developed under contract for the Manned Spacecraft Center. During the past twelve months, the company's customers have saved an estimated \$24,000 by using the revised sensor as compared to a previous version of the equipment

<u>Subject</u>	<u>Technology Source</u>
Research, Incorporated R-I Controls Division P.O. Box 6164 Minneapolis, Minnesota 55424 612-914-3300 Contact Mr. A. F. Kitchar Radiant Heating Manager	Manned Spacecraft Center Tech Brief 66-10531, "Heat Flux Sensor Design Reduces Extraneous Source Effects"

R-I Controls Division manufactures and sells power temperature controls and radiant heating equipment to industrial and aerospace markets. The company obtained a nonexclusive license from NASA to produce the revised sensor, which differs from the original NASA-developed sensor in that it features a quick-disconnect connector mounting and a heavy aluminum case. The sensor is used in the testing of space vehicle articles in high vacuum space chambers.

Mr. Kitchar, the manager of the radiant heating department, estimated that customers using the revised sensor have saved an estimated \$24,000 in the last twelve months. He said the savings resulted because the new sensor does not require support equipment, such as water cooling gear, which was required with a previously used sensor.

Mr. Kitchar doesn't expect sales volume of the sensor to be significant next year because of recent cutbacks in government expenditures for aerospace systems.

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Case Number 90526638

The head of a micro-electronics design group requested a TSP to help solve heat dissipation problems in an electronics system. The innovation was adopted and an estimated \$1,000 was saved in the past year, savings are expected to be \$8,000 next year. The TSP was developed under contract for Marshall Space Flight Center.

<u>Subject</u>	<u>Technology Source</u>
Underwater Sonar Systems Division Sperry-Rand Corporation Huntington, New York 11743 516-574-0111 Contact Mr. Basil T. Barber Research Section Head	Marshall Space Flight Center Tech Brief 67-10426, "Aluminum Heat Sink Enables Power Transistors to be Mounted Integrally with Printed Circuit Board"

The Underwater Sonar Systems Division of Sperry-Rand Corporation designs and manufactures sonar systems, primarily for the U S Navy. Mr. Barber, Research Section Head, was involved in a classified project which had a requirement for a high-powered linear audio amplifier. Heat dissipation is a serious problem in these compact, high-powered units. Mr. Barber became aware of the TSP, which describes a module containing an integral heat sink, in Electronic Design.

Mr. Barber said the module system was the best compromise after comparing it with standard heat dissipation techniques such as fans, air cooling and water cooling. The electronic module described in the TSP requires less wiring and is readily assembled into larger units. Due to time saved in the manufacturing process, the company realized a savings of \$1,000 during the past year. Mr. Barber estimated that an additional \$8,000 will be saved in the next year as a result of increased production.

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Case Number 90627858

A small Eastern ceramics manufacturer needed to establish a method for controlling certain contaminants in its production of a new product. By using the "Contamination Control Handbook" developed for Marshall Space Flight Center, the company was able to develop a simplified system providing more effective control.

<u>Subject</u>	<u>Technology Source</u>
H. I. Sherwood, Incorporated Sherwood Refractories 16601 Euclid Avenue Cleveland, Ohio 44112 216-531-8900 Contact T. A. Loxley Assistant Director R & D	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

Sherwood Refractories, a division of H. I. Sherwood, Inc , manufactures ceramics for industrial use. In manufacturing its products, the company normally is not concerned with clean room technology, however, a new electrically fused silica which the company recently began producing requires controls over certain types of contaminants. Company engineers, using basic principles presented in the "Contamination Control Handbook, " established a system providing the required control. The assistant R & D director indicated the handbook not only provided reference book assistance, but also saved the company the cost of using consultants.

He said a representative of the Small Business Administration (SBA) recently met with him to discuss the SBA and NASA Technology Utilization Programs and their potential contributions to small businesses.

RLB ed
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Case Number: 90627905

A small Northeastern firm produces uniform films on curved substrates by using a technique described in a TSP developed for Marshall Space Flight Center

<u>Subject</u>	<u>Technology Source</u>
Research Service Company 1149 Massachusetts Avenue Arlington, Massachusetts 02174 617-643-0060 Contact: Mr Max G Troesch Owner	Marshall Space Flight Center Tech Brief 68-10256, "Graphite Cloth Facilitates Vacuum Evaporation of Silicon Monoxide"

The Research Service Company is a small business specializing in the production of thin-film, high-vacuum depositions on electronic and optic components. The business is oriented toward servicing research programs conducted by colleges and universities.

Company owner Max Troesch was confronted with the problem of how to achieve an even deposition on a paraboloidal substrate surface. Since deposition thickness is dependent upon the distance between the substrate and the evaporant source, it is necessary to shape the source to conform to that of the substrate.

The flexibility of the graphite cloth, described in a Marshall TSP, permitted Mr Troesch to perform an operation he could not otherwise have performed. Mr Troesch stated his firm has been able to save money by using the handbook, although he could not estimate the magnitude of savings. He also indicated savings may occur during the coming year.

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1/16/70

Case Number 90627949

A small Midwestern manufacturer of electrical insulating resins improved the thermal conductivity characteristics of its products by using a TSP developed for Marshall Space Flight Center. The TSP, which identified the thermal conductivities and dielectric constants of nonmetallic materials, aided the manufacturer in selecting fillers to be used in resins. Not only did the company improve its products, but it also saved the cost of a planned materials research program.

<u>Subject</u>	<u>Technology Source</u>
Grodan Manufacturing and Sales, Incorporated 10319-21 Grand River Avenue Detroit, Michigan 48204 313-846-4410 Contact H M Lester Research Director	Marshall Space Flight Center Tech Brief 68-10351, "Thermal Conductivity and Dielectric Constant of Silicate Materials"

Grodan Manufacturing and Sales, Inc., is a small Michigan company manufacturing electrical insulating resins and structural adhesives. In the company's electrical insulating resins, nonmetallic fillers are suspended in resins to permit thermal conductivity through resin materials. Since the thermal conductivity characteristics of the fillers are very important to product capability, company officials had planned to undertake a materials research program investigating those characteristics. The company was able to suspend its research plans, however, after receiving a TSP developed for Marshall Space Flight Center. The TSP identified the thermal conductivities and dielectric constants of non-metallic materials. That information aided Grodan engineers in their selection of resin filler materials. Research Director H M Lester said their use of the TSP not only resulted in product improvements, but that it also saved the cost of a major R & D effort.

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Case Number 90627950

A small Eastern consulting firm specializing in the solution of container handling, servicing, and manufacturing problems received and used NASA information on a method for determining gas leakage rates. The technology, reported in a Marshall Space Flight Center TSP, allows for quantitative estimates of the leakage rates based upon bubble formations. The NASA information was considered crucial by the firm as a testing method on a new product being developed.

<u>Subject</u>	<u>Technology Source</u>
Harold Smull Associates, Incorporated , 264 Barwynne Lane Wynnewood, Pennsylvania 19151 215-649-6412 Contact: Harold Smull President	Marshall Space Flight Center Tech Brief 68-10393, "Determining Gas Leakage from Bubble Formations"

Harold Smull Associates, Inc , is a small Pennsylvania industrial consulting and research firm, specializing in the solution of container handling, servicing and manufacturing problems. Mr Smull said the NASA information for determining gas leakage rates was requested to alleviate a problem in testing a new product being developed.

Since the new product is being considered for patent application, Mr Smull was not at liberty to discuss the exact use of the TSP. However, he said the NASA method was generally used as a testing technique on leak detection systems used in container testing. He considered the method to be crucial since it provided a means of verifying the plumbing in the hardware being developed.

Mr Smull commented that the NASA information was "beautifully prepared" and enabled the firm to accept the information at face value and apply it directly. He was enthusiastic about the information and cooperation he has received from NASA, and said he has sent a letter to NASA expressing his appreciation. Mr Smull does not regularly receive NASA publications but has worked closely with the Small Business Administration for two years, receiving most of his

Case Number· 90627950 (Cont)

information through them He commented that "the Small Business Administration has been very helpful and quite responsive "

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1/27/70

Case Number 90628010

A small West Coast electronics company was faced with a heat dissipation problem on a high voltage regulator. The problem was solved when the company used a NASA-generated technique for anodizing its circuit boards. The technique, developed for Marshall Space Flight Center, not only contributed to reduced costs, but also allowed for a more compact system design.

<u>Subject</u>	<u>Technology Source</u>
Canoga Industries	Marshall Space Flight Center
Canoga Electronics Corporation	
8966 Comanche Avenue	Tech Brief 67-10425,
Chatsworth, California 91311	"Study Made of Anodized
213-341-3010	Aluminum Circuit Boards"
Contact N L Hannon	
Program Manager	

Canoga Electronics Corporation, a division of Canoga Industries, is a small company that manufactures antenna systems and various electronic instruments. Many of the company's products are low production, specialty items where component density and increased power are required. Problems of heat dissipation and alternate design are encountered frequently.

Recently faced with a heat dissipation problem in the design of a high voltage regulator, company engineers incorporated a hard anodized aluminum core circuit board technique into their design based upon information received from NASA. The result was the satisfactory dissipation of heat without being forced to incorporate an air cooling method into the design. Program Manager N L Hannon could not estimate the monetary savings resulting from the use of the NASA-developed technique, however, he indicated the technique had been very important in solving their problem. Mr. Hannon said his company subscribes to services of the NASA Regional Dissemination Center at the University of Southern California, in addition, he regularly reviews NASA Tech Briefs.

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Case Number. 90628021

Lewis Research Center developed a self-contained system that uses a solid lubricant for rolling element bearings required in spacecraft and satellite mechanical systems. The description of the lubricant in a TSP proved to be valuable to a small New England subcontractor working on the Manned Orbiting Laboratory (MOL) program. The subcontractor needed a similar lubricant and was able to apply the NASA information in some areas. Where the information could not be applied, it served as a valuable and cost saving guide in the subcontractor's other research and development activities.

<u>Subject</u>	<u>Technology Source</u>
Wayne-George Company Christing Street Newton, Massachusetts 02161 617-969-7300 Contact: J. J. Di Ciaccio Mechanical Engineer	Lewis Research Center Tech Brief 68-10165, "Bearings Use Dry Self- Lubricating Cage Materials"

Wayne-George Company, a division of Itek Corporation, is a small manufacturer of encoder systems and digital measuring devices. The company was a subcontractor on the Manned Orbiting Laboratory (MOL) program responsible for supplying an encoder system to a major contractor. In meeting space application requirements, the company needed a totally different bearing lubricant than it normally would use.

Company engineers were able to meet the requirements for the encoder system by using a TSP from Lewis Research Center. The TSP also served as a guide in directing other research and development activities within the organization. Although a company engineer could not estimate the savings resulting from TSP use, he said the document contributed to definite savings in research time and effort.

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Case Number: 90728494

A TSP developed for the AEC-NASA Space Nuclear Propulsion Office on the multiple aspects of fusion welding has been used by a major West Coast food processing company to update equipment welding standards and requirements. Based upon the improved standards and requirements, the company has been able to reduce equipment corrosion problems and to increase equipment longevity.

<u>Subject</u>	<u>Technology Source</u>
Foremost Food Company 111 Pine Street San Francisco, California 94111 415-392-5121 Contact J A Maldari Chief Engineer	Space Nuclear Propulsion Office Tech Brief 67-10200, "Workmanship Standards for Fusion Welding"

Foremost Foods Company engineers, responsible for maintaining certain types of processing equipment, became concerned about the low corrosion resistant quality of welds on the equipment. To determine whether they could improve the corrosion resistance of the welds, engineers studied the various welding specifications followed and also examined the various types of welding rods used with different alloys. In addition, they received a TSP from the Space Nuclear Propulsion Office dealing with fusion welding workmanship standards. As a result of their investigation, the engineers updated company welding standards as well as the requirements imposed upon equipment suppliers. The welding corrosion problem was eliminated.

Although the company's Chief Engineer said the NASA manual was only moderately important in solving the total problem, he noted it provided answers to many technical questions. He could not estimate actual monetary savings involved, but indicated they were "significant." By eliminating the welding corrosion problem, maintenance problems were reduced and the effective utilization of equipment was increased.

The Chief Engineer said he learned of the availability of the NASA welding manual while attending an industry convention.

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Case Number· 90829338

A small East Coast manufacturer of communications equipment used NASA-generated technology in developing test equipment for in-house use. The TSP describes a phonocardiogram simulator, developed by Kennedy Space Center, which calibrates and verifies phonocardiograms used in physiological monitoring of astronauts in flight and during flight simulation. The test equipment will be used by the company in new product research and development activities.

<u>Subject</u>	<u>Technology Source</u>
Astrocom, Incorporated 311 East Park Street Moonachie, New Jersey 201-343-4095 Contact John C. Fletcher Vice President	Kennedy Space Center Tech Brief 67-10239, "A Phonocardiogram Simulator"

Astrocom, Inc., is a small manufacturer of military communications equipment. Although engaged primarily in government work, the company is in the process of developing equipment for commercial sale. Since the specific product research and development activities are considered proprietary, Vice President John C. Fletcher could not relate the exact nature of the company's activities. He did indicate, however, that his company is researching the general problem of patient monitoring systems.

Astrocom engineers have used the TSP in developing a piece of test equipment similar to the phonocardiogram simulator developed by NASA. The test equipment will be used for testing and taking measurements in the firm's product research and development activities. Although Mr. Fletcher said the NASA information was only slightly important in developing the test equipment, he estimated that the availability of the information saved approximately \$1,500 in design effort and about one month in development time. He stated that the importance of the NASA information was negated somewhat by general problems experienced in using the TSP. The most serious problem, according to Mr. Fletcher, was finding substitutes for components no longer available.

Mr. Fletcher received the NASA information through the Small Business Administration. Although the company does not regularly receive

Case Number 90829338 (Cont)

Tech Briefs, it does receive a summary of the government publications available through the Clearinghouse

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12/19/69

Case Number 90627310

A division of a large electronics company located in the Rocky Mountain area has used NASA information to verify experience and set up criteria on parallel gap soldering. A TSP, developed for Marshall Space Flight Center, provided guidelines for establishing process control and inspection criteria for parallel gap soldering of electrical connections.

<u>Subject</u>	<u>Technology Source</u>
Hewlett-Packard Company 1900 Garden of the Gods Road Colorado Springs, Colorado 80907 303-636-5111 Contact Alwyn Throckmorton Process Engineer	Marshall Space Flight Center Tech Brief 68-10257, "Inspection Criteria Ensure Quality Control of Parallel Gap Soldering"

The Colorado Springs division of Hewlett-Packard Company has developed a new process for mounting integrated circuits using parallel gap soldering equipment. Process engineer Alwyn Throckmorton said the company was looking for information on techniques of analysis of the parallel gap soldering operations when he learned of the Marshall Space Flight Center TSP. The TSP was used to verify past experience and to set up criteria on inspection of parallel gap soldering operations used in the new process.

Although Mr. Throckmorton said the NASA information was only slightly important in solving the total problem, it did give the firm confidence in the procedures used and helped in creating new process specifications. Mr. Throckmorton could not estimate the monetary savings that resulted from using the TSP, but said that having the information available at least saved the company a literature search.

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Case Number 90628149

A small West Coast company manufacturing semiconductors and memory modules for computers used the "Contamination Control Handbook" to establish production standards. Company engineers used the handbook, developed for Marshall Space Flight Center, to specify adequate contamination control levels, and to determine required types of equipment. In addition to serving as a valuable reference source, the handbook contributed toward over-all savings.

<u>Subject</u>	<u>Technology Source</u>
Computer Microtechnology, Incorporated 610 Pastoria Avenue Sunnyvale, California 94086 408-736-0300 Contact: E C Mollat Engineer	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

Computer Microtechnology, Inc., a new California electronics firm, manufactures semiconductors and memory modules for computers. Since contamination control is very important to the reliability of the company's products, an engineer was assigned to coordinate all aspects of setting up clean rooms and establishing the required controls. Even though the engineer, E C Mollat, previously had some general exposure to clean rooms and contamination control technology, he indicated he did not know at the time what class of clean rooms the company had nor what the requirements might be.

Mr. Mollat said he found the "Contamination Control Handbook" from Marshall Space Flight Center a valuable guide in his new assignment. He used the handbook to specify what class of clean rooms were required, to make equipment changes and other corrections in existing clean rooms, and to determine what types of equipment to purchase. Although Mr. Mollat could not estimate the monetary or time savings resulting from his use of the handbook, he said the contributions were significant. Thus, he indicated it contributed toward improved

Case Number 90628149 (Cont)

processing and improved product yield and reliability Mr Mollat also commented that the company should find the handbook of further use as production operations expand

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Case Number· 90728246

A small Rocky Mountain manufacturer of wireless microphone systems initially ordered the "Contamination Control Handbook" as a general reference document. The handbook, however, has aided the company in the use of solvents and has identified less expensive solvent substitutes. The handbook, developed for Marshall Space Flight Center, has helped the company increase product efficiency while decreasing operating costs.

<u>Subject</u>	<u>Technology Source</u>
Electronics Development Corporation 82 West Louise Avenue Salt Lake City, Utah 84115 801-467-9487 Contact Richard Fullmer Engineer	Marshall Space Flight Center Tech Brief· 68-10392, "Contamination Control Handbook"

Electronics Development Corporation is a small Salt Lake City company manufacturing wireless microphone systems. Since a number of solvents are used in its clean line operation, company engineers were interested when the Utah Industrial Services Agency advised them that the NASA handbook was available and contained information on solvents.

Although the handbook was ordered for use as a general reference document, it proved to be a useful source of answers to specific technical questions. Information in the handbook helped the company develop more efficient clean line operations. Company engineer Richard Fullmer commented that the most important contribution made by the handbook so far has been in identifying solvent substitutes. For example, the company replaced two solvents used in large quantities with less expensive substitutes. Although Mr. Fullmer could not estimate savings associated with his use of the NASA handbook, he remarked that the reduction in operating costs would be a continuing benefit.

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Case Number 80813975

A technician working with ground support equipment in a rocket test program at Arnold Air Force Station, Tennessee, regularly uses the Marshall Space Flight Center "Fluid Properties Handbook" to determine physical properties for the common gases employed in rocket motor testing.

<u>Subject</u>	<u>Technology Source</u>
ARO, Incorporated Arnold Air Force Station, Tennessee 37389 615-455-7566 Contact Bobby G. Earps Technician	Marshall Space Flight Center Tech Brief 67-10440, "Fluid Properties Handbook"

ARO, Incorporated, a contractor at Arnold Air Force Station, Tennessee, provides ground support for rocket motor testing at Arnold Research Center, for the U.S. Air Force and for other Center contractors. This work involves regular use of helium, hydrogen, oxygen and nitrogen. Since information on the physical properties of these gases is needed regularly for design and construction of equipment and piping, the Marshall Space Flight Center "Fluid Properties Handbook" has proved to be valuable as a time-savings reference.

Company technician Bobby G. Earps estimated a two percent savings for every hour he has used the publication in rocket motor testing. He also estimated he would realize the same savings in any new test where set up time varies from six months to two years. The savings accrue from having a composite reference rather than several different documents. The handbook is being retained for future reference. While he appreciated having the TSP, Mr. Earps noted that it was poorly printed and that it omitted some "essential" data.

HWZ ed
9/29/69

Case Number 81221368

A TSP helped engineers in a Northeastern electronics firm coordinate and complement on-going research directed toward the application of this technology to radar and computers products.

<u>Subject</u>	<u>Technology Source</u>
Sperry Rand Research Center 100 North Road Sudbury, Massachusetts 10776 617-369-4000	Goddard Space Flight Center Tech Brief 68-10069, "Principles of Optical-Data Processing Techniques"
Contacts Frank W Mayock Marketing Manager Dr. Richard W. Damon Physicist Dr. William Malloney Project Manager	

Sperry Rand Research Center had been applying the technology described in the Goddard TSP to its radar signal interpretation for several years before the TSP was noted by Marketing Manager Frank W. Mayock. Mr. Mayock requested the document to update his knowledge of the state-of-the-art as well as to improve the related presentations he regularly made for company project funding.

Mayock routed the TSP to research, technical management, and marketing personnel. Each group spent more than twenty hours examining the TSP to understand the problems involved in coordinating their separate efforts. In this respect, Mayock stated "the document was excellent " Project Manager Dr William Malloney found the TSP "extremely well-written background material. " He has published a number of scientific papers on Sperry Rand research in optical-data processing in which he used the TSP to provide basic data.

Company physicist Richard Damon, estimated that Sperry Rand realized a savings of \$5,000 by using the TSP. He estimated a ten percent contribution was made by the TSP in the application of optical-data

Case Number: 81221368 (Cont.)

processing techniques to computers where 500 research hours had been spent in literature review and 5,000 research hours had been spent in development

HWZ:ed
9/29/69

Case Number· 90323622

The assistant plant engineer for an ethical drug manufacturer has found the information on gas leakage contained in a TSP to be useful in estimating leakage rates from low temperature systems. The TSP, developed by Marshall Space Flight Center, contributed toward time and indirect monetary savings for the firm.

<u>Subject</u>	<u>Technology Source</u>
Ayerst Laboratories, Incorporated Rouses Point, New York 12979 518-297-2111 Contact George F. Volzing Assistant Plant Engineer	Marshall Space Flight Center Tech Brief 68-10393, "Determining Gas Leakage from Bubble Formations"

Production processes at Ayerst Laboratories, Inc., require close control of the environment where drugs are prepared. Assistant Plant Engineer George Volzing stated that if a leak occurs, a decision to halt production is highly dependent upon the estimated leakage rate. In some cases, a shut-down may cause Ayerst to lose an entire batch of drugs valued anywhere from \$500 to \$10,000. An electronic leak detector is used to locate a leak, and the method suggested in the TSP is now being used to estimate the gas leakage rate. Mr. Volzing said the NASA-developed method was "just as good, if not better" than the one used previously.

Mr. Volzing could not estimate direct financial benefits, but noted the new method has saved his company several man-hours of engineering time. He estimated that 80 man-hours were used during the past eight months in putting the method into operation.

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Case Number. 90526614

The "Contamination Control Handbook," developed for Marshall Space Flight Center, has proven a useful tool to a large Southwestern mining and manufacturing corporation. The handbook, which company personnel refer to in solving industrial hygiene problems, saved the company more than 100 man-hours of work

<u>Subject</u>	<u>Technology Source</u>
Kennecott Copper Corporation Utah Copper Division Box 11299 Salt Lake City, Utah 84111 801-322-1533 Contact: F K Yeates Industrial Hygiene Engineer	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

Industrial hygienists in Kennecott Copper's Utah Division have found a NASA contamination control handbook useful in solving many day to day technical problems. Kennecott engineer F K Yeates indicated the handbook has been especially helpful in receiving, controlling, and testing various materials used by the Division. Before receiving the handbook, he said many hours were spent reviewing several sources for the required solution to many contamination control problems.

Mr. Yeates estimated his company saved approximately 100 man-hours last year by using the handbook. Assuming continued use of the handbook, Mr. Yeates estimated time savings of more than 100 man-hours per year.

Mr. Yeates said he does not normally receive NASA publications. He indicated he does receive a bibliography of the documents available through the Associated Industrial Services of Utah, a service offered by the University of Utah.

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Case Number. 90627642

A small Southwestern manufacturer used training manuals received from NASA to develop a better understanding of welding and magnetic particle testing of welds. The training manuals, developed under contract for Marshall Space Flight Center, were important to this small company in meeting welding and testing requirements.

<u>Subject</u>	<u>Technology Source</u>
Kaufman Fabricators, Incorporated Box 151 Kaufman, Texas 75142 214-932-2171 Contact M Darkoch Plant Manager	Marshall Space Flight Center Tech Brief 68-10391, "Training Manuals for Nondestructive Testing Using Magnetic Particles"

Kaufman Fabricators is a small company that manufactures transmitting and microwave towers. The company had received two unusual jobs requiring three inch plate welding and some bending that the company was not equipped to handle. In addition the jobs required X-ray and magnetic particle testing of welds.

Mr Darkoch stated that the company subcontracted the X-ray requirements, but trained a foreman to perform the magnetic particle testing requirements by using the NASA manuals. The company was able to develop the capability to weld three inch plate material and meet bending requirements by cutting and welding in lieu of pure bending. Mr Darkoch said the training manuals were important and helped the company better understand the welding requirements and testing methods that could be used to verify the welds. Although Mr Darkoch could not estimate the monetary and time savings contributed by having the NASA information available, he said there were savings. The manuals will be maintained as reference materials and guidelines on future jobs.

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Case Number 90627837

An Indiana paint manufacturer is developing a new radiation-curable paint which requires sophisticated techniques of substrate preparation. Existing processes of substrate cleaning have been improved through the use of the "Contamination Control Handbook."

<u>Subject</u>	<u>Technology Source</u>
Beta Cure, Incorporated 648 North College Street South Bend, Indiana 46628 219-234-0038 Contact Roy S. Nickerson, Sr. Vice President and General Manager	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

Beta Cure, Incorporated, a wholly-owned subsidiary of the O'Brien Corporation, South Bend, Indiana, is developing a new radiation-curable paint. A significant degree of care and use of sophisticated cleaning techniques is required for preparation of the substrate prior to application of the paint. Known techniques were modified and extended as a result of information derived from a NASA contamination control handbook.

Savings in time and money have occurred, but their magnitude is not measurable. The paint will be ready for the market during the first half of 1970, at which time it will be more feasible to isolate and specify the economies associated with the information taken from the handbook developed for Marshall Space Flight Center.

Beta Cure has been a regular recipient of Tech Briefs for two years. The company learned of the NASA Technology Utilization Program through a seminar sponsored by the Small Business Administration. The firm has considered utilizing the services of NASA's Regional Dissemination Centers, but has found them to be "too expensive" in terms of its needs.

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Case Number 90627847

The "Contamination Control Handbook," developed for Marshall Space Flight Center, was used by a small Michigan electronics manufacturing firm to convert some of its operations to clean room standards.

<u>Subject</u>	<u>Technology Source</u>
Energy Conversion Devices, Incorporated 1675 West Maple Road Troy, Michigan 48084 313-549-7300 Contact: Samuel Schankler Head, Quality Control	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

A new plant facility is being constructed for Energy Conversion Devices, Inc., a manufacturer of semiconductors and electronic components. The facility includes a clean room in which evaporative processes and a photolithic graphic process will be combined. The "Contamination Control Handbook" was used in drawing up clean room specifications for the new facility.

Quality control engineer Samuel Schankler commented that the TSP was useful in a general way, but lacked information on specific problems, such as determining different types of occupancy and permissible types of processes. The deficiency was not unique with the TSP, however. Inquiries were made among vendors of clean room equipment and people engaged in operation of clean rooms, and no one was able to solve the specific problems.

The economic impact of the TSP upon the firm's planning was too diffuse to be estimated. It may be possible in the future to ascribe dollar values to the contributions of the TSP as it is used in other projects, chiefly related to packaging and cleaning problems.

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Case Number 90627850

A California tape recorder manufacturer used a NASA document on contamination control procedures to improve decontamination processes related to a recorder used in space vehicles. The TSP, developed for Marshall Space Flight Center, contributed toward time and monetary savings for the company.

<u>Subject</u>	<u>Technology Source</u>
Kinelogic Corporation 873 South Fair Oaks Avenue Pasadena, California 91105 213-449-8707 Contact: R. J. Renault Senior Staff Quality Engineer	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

Engineers at the Kinelogic Corporation in Pasadena, California, were able to improve decontamination procedures in producing space vehicle recording tapes by using information in a NASA contamination control handbook. Mr. R. J. Renault, Senior Staff Quality Engineer, reported that some economies are probably attributable to his firm's use of the handbook, but their magnitude is unknown. A senior engineer who supervised the work related to the handbook is no longer with the firm, so it is impossible to specify the amounts of money and time savings that occurred. The handbook is a useful reference source, however, and will be used again as needed. Mr. Renault commented that he has a high regard for the NASA Technology Utilization Program, and said it has been beneficial to his company.

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12/23/69

Case Number: 90628008

A packaging technician employed by a West Coast electronics company used the "Contamination Control Handbook" developed for Marshall Space Flight Center to justify changes in company cleanliness requirements and standards. The company was experiencing organic contamination problems created by the lack of adequate cleanliness requirements. The handbook not only served to justify the needed changes, but the improved requirements have resulted in reducing rework costs created by the organic contamination.

<u>Subject</u>	<u>Technology Source</u>
West Coast Electronics Company Contact: Packaging Technician	Marshall Space Flight Center Tech Brief: 68-10392, "Contamination Control Handbook"

A West Coast division of a major electronics corporation was experiencing organic contamination problems in its semiconductor manufacturing area. According to a company packaging technician, the basic problem was suspected to be a result of the company's lack of cleanliness requirements and standards. The technician was able to justify the need for improved cleanliness standards by referring to information in the "Contamination Control Handbook." Workmen must now wear gloves and refrain from smoking and drinking on the production line.

Beneficial results have included improved workmanship standards and a definite reduction in the rework costs created by the organic contamination problem. The handbook is also being used in evaluating the effects of contamination on various materials used by the company.

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Case Number: 90729236

A research engineer employed by a major aerospace company is using the "Contamination Control Handbook" as a reference document. Use of the TSP, released by NASA's Marshall Space Flight Center, has resulted in research time savings of approximately 25 man-hours.

<u>Subject</u>	<u>Technology Source</u>
The Boeing Company Aerospace Group P O Box 3707 Seattle, Washington 98124 206-655-4581 Contact: David C Swinehart Research Engineer	Marshall Space Flight Center Tech Brief: 68-10392, "Contamination Control Handbook"

The Aerospace Group of The Boeing Company is engaged in the design and manufacture of aerospace hardware. A research engineer, David Swinehart, works in the manufacturing development area. He read about the TSP in the trade publication, Contamination Control. Because Boeing has contracts with the government, Mr. Swinehart was seeking information concerning NASA's recommendations on contamination control techniques. Mr. Swinehart described the handbook as a valuable reference and is now using it to help clarify specifications and procedures used in a laminar flow clean room.

Mr. Swinehart estimated 20 to 30 man-hours of research time were saved in the last year due to the availability of the document. This savings is expected to increase to 40 to 60 man-hours in the coming twelve months. Another probable benefit may be the improvement of manufacturing processes.

LS:ad
12/17/69

Case Number 90627614

A small West Coast manufacturer of specialty aircraft fasteners uses training manuals developed by NASA for training personnel in magnetic particle testing. The manuals, developed under contract for Marshall Space Flight Center, have been used as self-instruction aides for new metal parts inspectors in this small company.

<u>Subject</u>	<u>Technology Source</u>
Valley Bolt Corporation of America 12975 Bradley Sylmar, California 93142 213-367-2261 Contact. J. E. Tucker Supervisor	Marshall Space Flight Center Tech Brief: 68-10391, "Training Manuals for Non- destructive Testing Using Magnetic Particles"

Valley Bolt, a subsidiary of Lamson and Sessions Company, manufactures specialty aircraft fasteners which must conform to government specifications. In addition to other requirements, the government specifications require that magnetic particle testing be performed on the fasteners. This method of nondestructive testing is administered in accordance with applicable government specifications and is administered by qualified personnel.

Valley Bolt personnel interested in becoming qualified inspectors are given the NASA training manuals to study. After completing the self-instruction program outlined in the training manuals, they are sent to a two week school for additional training. A test is then administered which must be passed in order to become a qualified inspector. Supervisor J. E. Tucker said that the manuals are crucial to the Valley Bolt training program. He stated that the manuals offer an excellent self-instruction program which is particularly beneficial to individuals who have not had any prior experience in magnetic particle testing.

Although Mr. Tucker could not estimate the monetary savings that resulted from having the NASA training manuals available, he said that savings did result. The greatest benefit contributed by the training manuals, according to Mr. Tucker, was providing the company with the ability to develop more knowledgeable personnel.

RLB:lj
12/23/69

Case Number 90627828

Chemical milling production methods have been improved in a small Massachusetts firm, resulting in a sales increase of \$20,000 to \$30,000. A NASA TSP provided an input to the production improvement.

<u>Subject</u>	<u>Technology Source</u>
Tech-Etch, Incorporated 10 Industrial Park Road Hingham, Massachusetts 02043 617-749-0993 Contact: G. E. Keeler President	Marshall Space Flight Center Tech Brief 68-10385, "Electromotive Series Established for Metals used in Aerospace Technology"

Tech-Etch, Inc., manufactures small metal parts from large sheets of various nickel alloys. The manufacturing process, called chemical milling, involves an etching technique in which precisely controlled electrochemical reactions cut the small parts from the sheet metal.

A NASA document describing the electromotive characteristics of various aerospace metals and alloys was used by this firm to increase its production capabilities. The primary importance of the TSP for this application was general information on current densities and the relative positions of various metals in the electromotive series.

The economic significance of the use of the TSP has been an increase in the firm's capability to perform some types of work not previously possible. A sales increase of \$20,000 to \$30,000 was associated with performance of the new work.

Mr. George Keeler, President, reported that his firm does not regularly receive any NASA technical literature. The Office of State Technical Services at the University of Massachusetts frequently sends him publications lists, and a Small Business Administration (SBA) Technology Utilization Officer has occasionally sent bibliographic information. From these sources and a variety of trade publications, Mr. Keeler selects and orders technical literature appropriate to his needs.

A representative of the SBA visited Mr. Keeler about three months ago to offer a variety of services. Assistance with possible military

Case Number. 90627828 (Cont.)

subcontracting and referral of potential customers were among the services most attractive to Mr Keeler He is presently awaiting results of the SBA assistance

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12/23/69

Case Number 90628147

A Southern insurance company has found a NASA contamination control handbook helpful in preparing accident prevention booklets and in evaluating industrial accident claims.

<u>Subject</u>	<u>Technology Source</u>
Kemper Insurance 1401 Peach Tree Building Atlanta, Georgia 30309 404-892-1330 Contact G. A. Mayes Industrial Hygienist	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

The Industrial Hygiene Section of the Kemper Insurance Company is responsible for assisting client companies in preventing industrial accidents and evaluating workmen accident claims. A Kemper industrial hygienist, G. A. Mayes, indicated that a NASA contamination control handbook has been helpful in both areas of sectional responsibility.

One of the principal services provided by Mayes' section of the company is the publication of bulletins calling attention to potential industrial hazards. The NASA TSP was used as a source book in preparing bulletins describing the effects of solvents on materials used in personnel protective equipment.

The handbook, developed for Marshall Space Flight Center, also has been used as a reference book in evaluating industrial accident claims.

Mr. Mayes stated that the handbook has been a valuable document to his company, although he could not estimate time or cost savings associated with its use.

RLB lj
1/20/70

Case Number 90628160

Under contract to Marshall Space Flight Center, an investigation was conducted to establish process control and inspection criteria for parallel gap soldering of electrical connections. The information developed from this NASA investigation was used in an engineering study performed by the Air Force to develop improved component repair methods. As a result of this study, the technology for repairing advanced components was improved and operating costs were reduced.

<u>Subject</u>	<u>Technology Source</u>
U S Air Force Maintenance Technology Development Section Tinker Air Force Base Oklahoma City, Oklahoma 405-732-7321 Contact: Gordon L. Richard Physicist	Marshall Space Flight Center Tech Brief 68-10257, "Inspection Criteria Ensure Quality Control of Parallel Gap Soldering"

The Maintenance Technology Development Section of Tinker Air Force Base is responsible for developing maintenance technology and for consulting with other Air Force Units. In a recent study, section engineers were attempting to develop a report defining the latest in component repair technology. The report was aimed at developing a better understanding of the advanced components used in many Air Force systems. Engineers found a Marshall TSP, dealing with soldering quality control, helpful in preparing the report.

As a result of the study, many advanced system components previously disregarded were repaired. The improved capability not only reduced operating costs, but also contributed to improved system capability and maintainability. Although the NASA information was only moderately important to developing the required technology, it did contribute to the areas of the study dealing with parallel gap soldering and conventional circuitry.

Physicist Gordon L. Richard stated that definite monetary savings resulted from the study, but he was not able to estimate how much the NASA information contributed to these savings. Although he could not

Case Number 90628160 (Cont)

estimate how much working time was saved, Mr. Richard said that having the information available did save time and man-hours

RLB lj
12/24/69

Case Number· 90728474

While working with the Corps of Engineers on a new dam being constructed in Pennsylvania, a consulting engineer used a TSP on fusion welding. The manual, developed for the AEC-NASA Space Nuclear Propulsion Office, defines workmanship and standard practices in fusion welding that are subject to rigid codes and specifications. The use of the manual contributed by helping qualify a small subcontractor for work on the dam, and by reducing construction costs since new welding methods were employed which allowed for the use of lower grade steels.

<u>Subject</u>	<u>Technology Source</u>
P.O. Box 1963 Harrisburg, Pennsylvania 17105 717-761-0456	Space Nuclear Propulsion Office
Contact: William E. Seip Consulting Engineer	Tech Brief 67-10200 "Workmanship Manual for Welding"

An engineer working with a Pennsylvania consulting firm was faced with a quality control problem involving a small firm doing work on the new Foster Joseph Sayers Dam in Pennsylvania. The subcontractor had trouble meeting the welding qualification requirements and faced a cost overrun problem.

The AEC-NASA manual proved to be quite helpful in checking the subcontractor's welding procedures and getting his personnel qualified. The subcontractor had also requested a change allowing them to use T-1 steel in constructing the roller tracks in lieu of the high grade stainless steel required. Mr. Seip said that the greatest problem in granting the change was developing acceptable welding methods for T-1 steel. After considerable research and some help from the TSP, it was possible to grant the change. This resulted in a substantial savings on the overall construction cost of the dam.

Mr. Seip stated that although many of the decisions had been made before the AEC-NASA information was received, the TSP was helpful in solving some of the problems and contributed toward project savings. Mr. Seip does not regularly receive NASA Tech Briefs. He learned about the

Case Number 90728474 (Cont)

AEC-NASA information while attending an open house at an Army
installation

RLB:ad
12/24/69

Case Number· 90122408

A commercial soldering manufacturer was able to avoid the expense of designing and developing a new type of soldering tool when he reviewed a NASA TSP describing just such a tool. The TSP, developed for Lewis Research Center, saved the manufacturer many hours of research and development time.

<u>Subject</u>	<u>Technology Source</u>
Alpha Metals, Incorporated 56 Water Street Jersey City, New Jersey 07304 201-434-6778 Contact. William Finnie Manager Process and Development Laboratory	Lewis Research Center Tech Brief 66-10115, "Soldering Tool Heats Workpieces and Applies Solder in One Operation"

Solder and soldering chemicals have become quite sophisticated with the wider use of "exotic" metals and alloys, according to William Finnie, Manager of the Process and Development Laboratory of Alpha Metals, Inc. While the company's primary products are solder and soldering chemicals, company engineers are occasionally required to help solve customer problems by designing, developing, and even manufacturing soldering tools.

The company's president recently directed the laboratory to develop a self-contained soldering tool for microelectronic product applications. The soldering tool was to house the solder, heat the workpiece, and apply the solder all in one continuing operation. The design would then be evaluated for commercial sale.

Finnie began this assignment with a review of the company's NASA Tech Brief library where he learned that a soldering tool meeting the specifications had been developed for Lewis Research Center in 1966. He immediately terminated further efforts to develop the soldering tool.

According to Finnie, Alpha Metals saved many development hours because of the availability of this Tech Brief, which was so complete that detailed reference to the TSP was unnecessary. Alpha Metals

Case Number. 90122408 (Cont)

regularly receives Tech Briefs which Finnie evaluates as "clear, easily understood, and part of a good program. "

HWZ:ad

9/22/69

Case Number• 90627624

A Midwestern castings manufacturer, using data reported in a TSP, was able to convince a customer that nondestructive testing should be used on the customer's work. By implementing the new testing techniques, the customer significantly reduced manufacturing costs. The TSP, developed for Marshall Space Flight Center, is being used by the manufacturer for personnel training.

<u>Subject</u>	<u>Technology Source</u>
National Castings 2570 Woodhill Road Cleveland, Ohio 44104 216-229-3400 Contact: J W Dunbar Production Engineer	Marshall Space Flight Center Tech Brief• 68-10391, "Training Manuals for Non- destructive Testing Using Magnetic Particles"

Engineers at the National Castings company experienced difficulty convincing a customer to accept the results of nondestructive tests used in the production of certain castings. Production Engineer J W Dunbar said he found a NASA TSP useful in proving the effectiveness of the testing method to the customer. Although Mr Dunbar could not estimate the savings resulting from his use of the nondestructive testing method, it did contribute toward lower manufacturing costs.

The manuals also will be used in the future for training new operators in nondestructive testing techniques. According to Mr Dunbar, the TSP presents the method in a more understandable and clearer fashion than do other available sources.

Mr Dunbar does not regularly receive NASA publications. He learned of the availability of the NASA training manuals through a trade publication.

RLB•ad
12/22/69

Case Number: 90627744

A Midwestern company has the requirement to perform nondestructive testing of root passes in large welds using magnetic particles. The availability of training manuals, developed for Marshall Space Flight Center, made it possible for this company to train and qualify people on the job and led to reduced operating costs

<u>Subject</u>	<u>Technology Source</u>
Allied Structural Steel Company 1435 - 165th Street Hammond, Indiana 219-932-1300 Contact: J S Carter Executive Vice President	Marshall Space Flight Center Tech Brief: 68-10391, "Training Manuals for Non- destructive Testing Using Magnetic Particles"

The Allied Structural Steel Company is a medium-sized company which fabricates structural steel and erects bridges and buildings. Nondestructive testing is required on many large weldments. Such testing had been performed formerly by outside engineers since the company did not have qualified personnel. According to Mr. Carter, it was expensive to get outside help and nearly impossible to coordinate efficiently the availability of the vendor with the demands of the production schedule.

Mr. Carter personally receives NASA Tech Briefs and was aware of the training manuals available through NASA. When it was decided that future nondestructive testing would be done internally, it also was decided that the NASA manual would be used for on-the-job training of personnel. Mr. Carter estimated that with the manuals, the company has been able to save approximately \$1,500 in training costs. The major benefit derived from the training, however, is the efficiency possible with regular employees being qualified and readily available to perform the testing.

RLB:lj
12/16/69

Case Numbers 90627861, 90627862

Information contained in two TSP's has proven to be helpful to a small Midwest management consulting firm. The firm used information developed for Marshall Space Flight Center on the probable future areas of oceanographic research and a handbook on contamination control in its consulting work. Both documents have aided the firm and have contributed toward time and man-hour savings.

<u>Subject</u>	<u>Technology Source</u>
Bernard Wolnak and Associates One North Wacker Drive Chicago, Illinois 60616 312-263-1670 Contact Bernard Wolnak, Ph D President	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook" Tech Brief 68-10397, "Charts Designate Probable Future Oceanographic Research Fields"

Bernard Wolnak and Associates, a small management consulting firm, works with a number of companies in the biochemical field. Since various clients have questions or problems relating to the field of oceanography or in areas of contamination control, the firm is frequently called upon for its interpretation or to aid in solving specific problems in these areas.

Company President Bernard Wolnak said the NASA charts on probable areas of future oceanographic research have been quite helpful, since they provide information and data not available elsewhere. For the most part, the charts have served as an aide in the firm's consulting work and have also been used to verify the firm's own thinking in the field.

The firm uses the "Contamination Control Handbook" as a reference tool and has applied the section on microbial contamination control in solving specific problems. Although Dr. Wolnak was not at liberty to discuss specific applications, he stated the handbook has been helpful in setting up a contamination control system and in verifying methods which have been put in work.

Case Numbers: 90627861, 90627862 (Cont)

Dr Wolnak said the NASA information contained in two TSP's has been only moderately important to them, however, both documents have contributed toward time and man-hour savings Dr. Wolnak remarked that the charts on oceanographic research had insufficient information which somewhat negated their usefulness In his opinion, the information on the charts was directed too much at the expert and would be more valuable if more references and explanations were provided He felt the TSP on contamination control was "well presented" and served as "a good reference document "

RLB:ad
1/16/70

Case Number· 90729238

A Houston, Texas high school student has made novel and important use of a Lewis Research Center Tech Brief. As the basis for a Science Fair project, she is using the NASA information for experiments on pinpointing voids and poor bond lines in fiberglass laminates

<u>Subject</u>	<u>Technology Source</u>
Sam Houston Senior High School Houston, Texas 77022	Lewis Research Center
Contact: Miss Elaine Kmiec Student	Tech Brief· 67-10286, "Liquid Crystals Detect Voids in Fiberglass Laminates"

Elaine Kmiec, a junior at Sam Houston Senior High School, is experimenting with liquid crystals for a Science Fair project. The project is an analysis of this nondestructive testing technique in relation to the standard procedures using ultrasonics and X-rays

Although the Tech Brief pertains only to the use of this technique on fiberglass laminates, Miss Kmiec has expanded it to testing aluminum and titanium alloys. Boeing, North American Rockwell, Hughes Aircraft, and Lockheed are assisting in the experiment by sending her defective parts for analysis. Miss Kmiec tests the parts and sends reports to the companies for review

Miss Kmiec has not finished her project for this year. However, last year she used liquid crystals to detect gas leaks and received awards from NASA, the Army and the Air Force

Miss Kmiec stated that the Tech Brief was a very important source of information and ideas. She could not think of any difficulties encountered in using the document.

RBH·ed
12/23/69

Case Number: 90525706

A large West Coast aerospace firm found a TSP on nondestructive testing useful in selecting tubing metal and an appropriate joint sealing technique for use in a new commercial airplane.

<u>Subject</u>	<u>Technology Source</u>
Lockheed California Company Lockheed Aircraft Corporation B-1 Facility Burbank, California 91503 213-847-1744 Contact: Leo E Gatzek Senior Quality Engineer	Marshall Space Flight Center Tech Brief 68-10394, "Nondestructive Testing of Braze Rocket Engine Components"

Early in 1969, Lockheed Aircraft engineers began a design review for the hydraulic system plumbing in the L-1011 Tri-Star (Airbus). Senior Quality Engineer Leo Gatzek reported that acquiring the Marshall TSP on nondestructive testing was an important step in developing the system. The TSP, along with additional information by the author of the TSP, provided specific suggestions on appropriate tubing materials and joint sealing techniques.

Mr. Gatzek described the TSP as being of "great value" in the project. He was not able, however, to estimate cost reduction associated with TSP use. He said the TSP was well written and added, "Any TSP document should be 98 percent straightforward explanation, with at most two percent theory. The person desiring more theory can always call the author."

HWZ:lj
10/6/69

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Case Numbers 90627782 and 90627857

A small chemical company located in the East has received NASA information on a new bacteriostatic coating and a handbook on contamination control which it has applied to new thinking in product research and development. The coating, developed by Goddard Space Flight Center, is capable of hindering bacterial reproduction and was developed to ensure biological decontamination of electronic components and assemblies in spacecraft going to other planets. The "Contamination Control Handbook" was developed by the Sandia Corporation under contract to Marshall Space Flight Center. Both TSP's have encouraged new thinking, aided in development of a possible new product line, and have created a new awareness of the potential markets for the company

<u>Subject</u>	<u>Technology Source</u>
Steri-tized, Incorporated P.O. Box 104 Peekskill, New York 10566 914-PE7-8266 Contact: M Kadison President	Goddard Space Flight Center Tech Brief 67-10599 "Bacteriostatic Conformal Coating for Electronic Components"
	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

Steri-tized, a small chemical company, manufactures bacteriostats, fungicides, and other bactericides for industry. In conjunction with its line of bactericides, the company is constantly looking for new product lines and for new areas of potential sales application

Company President M Kadison stated that his firm was working on a new bacteriostatic coating when he learned of the coating developed by NASA. Based upon the information received from NASA and from its own research, Mr. Kadison has developed a potential new product line and has come up with ideas for other possible applications of bactericides. The new coating is currently being tested in accordance with the government requirements for labeling economic poisons. Although a formal market analysis has not been completed, the new coating is expected to increase the company's sales volume considerably

Case Numbers: 90627782, 90627857 (Cont)

The handbook on contamination control has been used to improve several testing procedures and also has resulted in developing a new awareness of the potential market for the company's products among several government agencies, including NASA. Mr. Kadison was confident that the sterilizing capabilities of their products can be important in space suit and space capsule applications.

Although Mr. Kadison could not estimate the monetary savings resulting from his use of the NASA information, he said it was significant. Mr. Kadison expressed the importance of the Technology Utilization Program to his company, which is too small to warrant or afford a research staff. By using NASA-generated technology announced in Tech Briefs, the company is able to acquire the most sophisticated technology available. He has written his Congressman and Senators to express his appreciation of the program.

Representatives of the Small Business Administration called on Mr. Kadison several weeks ago to discuss Technology Utilization activities. Since he has been using Tech Briefs for two years, he was already well informed about the program.

RLB:lj
12/29/69

Case Number 90627811

An engineering laboratory is evaluating an instrument described in a TSP for possible product development. The potential product would be used by surveyors to help detect buried metallic boundary stakes. The TSP describing the detector was developed by Marshall Space Flight Center.

<u>Subject</u>	<u>Technology Source</u>
Geophysical Instrument and Supply Company, Incorporated 900 Broadway Denver, Colorado 80203 303-825-5900 Contact. Mr. A. A. Danish General Manager	Marshall Space Flight Center Tech Brief 68-10183, "Detection and Location of Metallic Objects Imbedded in Nonmetallic Structures"

SOILTEST, Inc., manufactures ore, oil, and water exploration instruments for geologists, engineers and surveyors. A division of SOILTEST, Geophysical Instrument and Supply Company (GISCO), distributes these products throughout the world.

The general manager of GISCO, Mr. A. A. Danish, said he has had frequent requests from surveyors for a device which would help locate buried metallic boundary stakes. When he received information through the Small Business Administration concerning a metallic object detector developed by NASA, he requested further information thinking a new product might be developed. He turned the TSP over to SOILTEST's engineering laboratory in Wisconsin for evaluation and possible product development. Mr. Danish said he expects a report from his laboratory concerning the potential object detector in April 1970.

LS lj
1/28/70

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Case Number: 90627830

A New York firm is transferring expertise gained on a project for the U. S. Navy to development of products for air pollution control. A Marshall Space Flight Center handbook on contamination control techniques, used on the Navy project, is being used in development of the effluent-control products.

<u>Subject</u>	<u>Technology Source</u>
The Air Preheater Company, Incorporated New Product Group Wellsville, New York 14895 716-593-2700 Contact Eugene D. Krumm Supervisor	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

The Air Preheater Company manufactures an extensive line of air preheaters (used by public utilities), compact heat exchangers, commercial and industrial fans, fume incinerators, solid waste incinerators, and conveyors and cranes. The incinerators are relatively new product lines for the company. Expertise in effluent measurement and control acquired on a Navy contract is being put to use in perfecting these pollution control devices.

A heat exchanger component of an air purification system for nuclear submarines was developed by the firm under a Navy contract. A catalyst system was being used, and a means was required to measure effluent from the system. A NASA handbook on contamination control methods was acquired, and provided an important input to the development of the measuring system. This information is now being transferred to more conventional product lines related to air pollution control mechanisms. To date, the handbook has been responsible for measurable savings to the firm, largely in the form of time. As much as \$2,500 may have been saved by the time reduction. In addition, while difficult to estimate, some monetary savings occurred since the firm did not have to retain a consultant to provide the information that was found in the handbook. Additional cost reductions are likely in the future as the technology is applied in development of new and better air pollution control devices.

The Air Preheater Company is a regular user of NASA technological information. A subscription to Tech Briefs has been in force for

Case Number· 90627830 (Cont)

some time. The company also receives about 300 documents per year from the Aerospace Research Applications Center. A retrospective search for literature relevant to solid waste incineration and disposal will be contracted in the near future

Eugene D. Krumm, Supervisor of the New Product Group, commented that many Tech Briefs are too esoteric for the average engineer, and the style and content often make the documents unattractive to the ordinary, potential user. His firm has several Ph D staff members, who screen and digest the documents with ease, but other personnel have complained occasionally about the difficulty and abstract state of the documents

WH:ad
12/22/69

Case Number· 90627958

A small California firm used a Tech Brief in the development of an adhesive sample and in the preparation of a proposal presented to another firm. The Tech Brief, developed under contract to NASA's Western Operations Office, saved the firm approximately 40 to 50 man-hours of research time.

<u>Subject</u>	<u>Technology Source</u>
LUSOL Company P. O. Box 1033 El Monte, California 213-283-9233 Contact· Mr. David MacDonald General Manager	Western Operations Office Tech Brief· 66-10185, "Improved Adhesive for Cryogenic Applications Cures at Room Temperature"

The LUSOL Company is a small California firm engaged in the custom compounding of epoxy resins, silicones, and polyurethanes for both high- and low-temperature applications. The firm, which tailor-makes each product according to the buyer's needs, has from 300 to 400 products.

Mr. MacDonald was preparing a proposal to supply another firm with an adhesive which would provide an effective metal-to-metal bond at low temperatures. He developed a sample to meet those requirements and used a NASA Tech Brief to substantiate his proposal. At present, Mr. MacDonald has no plans to produce the new product since the other firm has not responded to his proposal.

Mr. MacDonald estimated his firm saved some 40 to 50 man-hours of research time while preparing the sample order by using the Tech Brief.

LS:ad
1/16/70

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Case Number: 90628014

Two medical instrument designers are using an Electronics Research Center TSP as a basis for developing an inexpensive nosepiece monitor for use in the diagnosis of certain diseases

<u>Subject</u>	<u>Technology Source</u>
Midwestern Corporation Engineer	Electronics Research Center Tech Brief 68-10438, "Nosepiece Respiration Monitor"

An engineer and a physician working in Chicago are attempting to build a respiration monitor which would be inexpensive enough for doctors to use in their offices. The monitor would provide eye, ear, nose and throat specialists with data on the rate and amplitude of a patient's respiration.

The engineer used a TSP, developed for Electronics Research Center, to produce a prototype of the monitor he wishes to construct. He stated that the TSP would have been much more helpful if the electrical values of system components had been listed on the schematic diagram.

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12/18/69

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Case Number 90728542

A stepping drive, designed by Marshall Space Flight Center, has been adapted to a digital clock for commercial use by a small West Coast company. The stepping drive initially designed for precise incremental angular positioning of scale models of spacecraft about a horizontal axis in order to accurately measure antenna receiving and transmitting characteristics has been adapted to a mechanical drive digital clock. The new digital clock is expected to receive wide distribution and increase the sales volume in this small company by \$500,000 per year.

<u>Subject</u>	<u>Technology Source</u>
Ropat	Marshall Space Flight Center
5558 Centinela Boulevard	
Los Angeles, California 90066	Tech Brief: 68-10549,
213-391-0414	"High-Torque Precision
Contact: William D. Clark, Ph. D	Stepping Drive"
President	

Ropat, a small company currently employing eight people, designs and markets digital clocks which are fabricated under agreement with foreign sources. The present digital clock, sold under the trade name Cas-lon, has an indexing mechanism which is driven by an electric motor. Although the present digital clocks are quite satisfactory, attempts have been made to design a clock that would operate mechanically using a tuning fork.

According to Dr. Clark, after receiving the TSP, it was possible to nearly duplicate the mechanism and design a new digital clock. The new clock uses a plastic molded stepping drive that allows for continuous, accurate operation using a tuning fork for indexing once a minute. Although the company hoped to have the new clock on the market in time for Christmas sales, it is now expected to be ready within two or three months. Sales volume on the new clock is expected to be around 50,000 units, assuming acceptance by certain distributors, which would increase Ropat's annual sales by \$500,000. The new clock also lends itself to automotive use. According to Dr. Clark, if the company can gain acceptance by the automotive industry, the present sales forecast would be very conservative.

Dr. Clark could not estimate how much was saved due to the availability of the NASA information, but said it was crucial to the company's ability

Case Number· 90728542 (Cont)

to develop the new product. The TSP made it possible to work out an idea that had been in development, but had not been previously solved

RLB ad
12/23/69

Case Number 91233604

A Maryland firm, while performing research for NASA, made interesting discoveries in the field of shock hydrodynamics. As a result of the tests, the firm expects to develop a valuable tool for mining and construction purposes

Subject

Exotech, Incorporated
Rockville, Maryland
301-427-0707
Contact David L. Fain
Vice President-Marketing

News stories in Business Week (July 19, 1969) and The Washington Post (July 27, 1969) described plans of Exotech, Inc , to develop new technology in the field of shock hydrodynamics. This technology is partially based upon findings of research conducted to investigate certain aspects of micrometeoroid impact on space vehicles. Micrometeoroid were simulated by small gas bursts propelled at high speeds. Exotech's primary concern was development of monitoring instruments, and the micrometeoroid simulation was undertaken to provide means for calibrating the monitoring gear. The mechanical engineers working on the project were intrigued with the results of the tests. Dr. William C. Cooley, and M. I. T. graduate with a strong research orientation, and other engineers "brainstormed" and concluded that the same principles utilized in the gas propulsion system could be applied in hydraulic devices.

Two devices have been tested, and plans are being made to combine the unique features of each in a hybrid tool that will be valuable in mining and construction. One device is a water cannon that fires ten pulses per second with an impact pressure as great as 80,000 psi. The other device is called a "cumulative" jet, it fires a small amount of liquid at a speed of 25,000 feet per second, impacting at 50,000 psi. A hybrid combination of the two approaches may yield impact pressures of 1,000,000 psi, and will revolutionize mining and tunnel boring. According to David Fain, Vice President-Marketing, one cubic foot of water will move two cubic yards of rock. The cutting rate would be as much as ten times greater than that of any known technique. The device would work like explosives, ripping into and fracturing its structure (unlike low pressure water drilling which gradually erodes and weakens

Case Number: 91233604 (Cont)

rock's compressive strength). No mechanical equipment is involved; there are no drills to wear out, there are no delays to set explosive charges; and boring can proceed as rapidly in hard, as in soft, rock.

A market analysis by Mr. Fain indicates the existence of a "phenomenal" market for the hybrid tool. Experiments conducted with the two existing devices for the Army and the Navy provide a firm basis for confidence in the technical feasibility of the intended development. A joint venture with a construction firm is ready to begin, and a salable product is anticipated within one to two and one half years. Meanwhile, the jet application is being pursued in order to perfect a tool for the metal-working industry. Existing models can penetrate through 1/2-inch steel plate. Experiments also indicate that the jet will perform underwater; a 3/8-inch steel plate has been penetrated in underwater tests.

According to Mr. Fain, the NASA input to the projects now underway at Exotech is remote. The experience achieved by the firm's engineers in high velocity applications has been helpful, largely, to stimulate their conceptualization of new applications. He also cited the conducive environment at Exotech as a factor of great significance in the successful adaptations achieved by these engineers.

WH:ad
10/3/69

Case Number• 91233606

An Eastern textile company is participating in a program to develop an automobile crash bag safety device. The idea for the device occurred to company engineers developing uprighting bags for Apollo command modules.

Subject

West Point Pepperell
Industrial Fabrics Division
111 West 40th Street
New York, New York 10018
212-564-0700
Contact: Joseph Lamier, Jr
President

As a subcontractor to Goodyear Aerospace Corporation and North American Rockwell's Space Division, the Industrial Fabrics Division of West Point Pepperell developed a special fabric for the "uprighting bags" on Apollo command modules. The uprighting bags are three automatically inflating balloons which are deployed at splashdown. In the event that the module were to overturn, the balloons would immediately upright the capsule. West Point Pepperell's contribution was a polyester fabric coated with polyurethane. Goodyear then utilized the treated fabric for constructing the inflatable balloons.

Pepperell engineers, using the Apollo-generated technology, are trying to perfect an automobile crash bag safety device. The crash bags are designed to inflate automatically if an automobile is involved in a collision. The inflated bag would be interposed between front-seat occupants and the dashboard, cushioning forward motion and preventing injury.

Experiments have yet to demonstrate that the system will have an adequate "shelf life." A problem also remains of preventing accidental inflation of the bags, an occurrence that could constitute a hazard on the highway.

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10/22/69

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Case Number 91233607

A Maryland power tool manufacturer, subcontracting on the Gemini and Apollo programs, acquired technological expertise which is being applied to the development of commercial power tools

Subject

Black and Decker Manufacturing Company
Joppa Road
Towson, Maryland 21204
301-828-2920
Contact Robert Riley, Jr
Director of Research

Black and Decker Manufacturing Company, under subcontract to the Martin-Marietta Corporation, developed two tools for the space program. One is a minimum-reaction torque wrench carried on Gemini Flights 8 and 11, but never used in orbit because of other problems. The other is a battery-powered lunar drill to be used on Apollo 13 for extracting core samples to depths of ten feet.

Black and Decker engineers are using the technology they generated in designing and building the Apollo Lunar Surface Drill (A. L. S. D.) to develop several commercial products. The permanent magnet motor, first used in cordless drills, was optimized in design by a computer program developed for the A. L. S. D. motor. The design method was then used to design a motor for a battery powered lawn mower, just put on the market. Computer studies of the percussor mechanism for the A. L. S. D. are being used to design higher efficiency mechanisms for Black and Decker commercial hammers. Other technology that will be useful commercially is related to materials and heat flow studies.

WH ad
12/29/69

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Case Number: 90323669

A small electronics firm on the West Coast has reviewed a TSP describing a heater control circuit. The president of the company stated that the NASA technology may be used in future environmental control systems which would result in cost reductions.

<u>Subject</u>	<u>Technology Source</u>
Coast Electronics, Incorporated 1305 - 5th Street Manhattan Beach, California 90266 213-376-6328, Contact: Walter E. Drake President	Marshall Space Flight Center Tech Brief 67-10097, "Heater Control Circuit Provides Both Fast and Proportional Control"

Coast Electronics, Inc., a small Western electronics specialty firm, designs and manufactures oceanographic instrumentation on a contract basis. The President of Coast Electronics, Walter Drake, stated that his company already had a proportional control circuit similar to the one described in the TSP. As a result, it has not used the new information as yet, but is considering the possibility of including the device described in the TSP as part of an environmental control system. Drake considers the innovation to be important because it will lower the cost of the system and also make it more reliable.

Mr. Drake learned of the TSP from the Small Business Administration Office in Los Angeles. He feels that "most of the Tech Briefs from NASA have been quite well presented" and he gave this TSP a high rating.

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9/11/69

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Case Number 90425046

A wide-band, radio frequency signal processing and analysis technique, described in a Goddard Space Flight Center TSP, is being considered for an electronic warfare product by a major defense contractor. If the new optical laser technique is used, the company would realize a cost savings through an improved product.

<u>Subject</u>	<u>Technology Source</u>
Major Defense Contractor East Coast	Goddard Space Flight Center Tech Brief 68-10069, "Principles of Optical-Data Processing Techniques"

An East Coast defense contractor, after reviewing a NASA TSP, decided that cost economies and operational efficiencies could be achieved by using a new technique for processing and analyzing radio signals within an electronic warfare product. Product redesign would include replacement of a crystal filter scanning device with an optical laser beam. Incorporating the new optical laser would improve the product by greatly increasing its operating speed and by providing continuous values over a wide range of frequencies. When applied, major cost savings would be realized in producing the signal processing equipment component. To date, the technical change is still in the proposal stage.

The contractor commented that the Tech Brief and TSP were clearly written and well organized. He said the TSP was helpful in preparing job descriptions. The contractor indicated he was not familiar with Tech Briefs or TSP's prior to this encounter. He emphasized the need for technology documentation in other technical fields, however, where the straight-forward presentations of the state-of-the-art are needed, particularly where interrelated disciplines are involved.

HWZ ad
8/28/69

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Case Number 90628032

A research and development engineer, employed by a Midwestern magnetic tape manufacturer, requested a TSP in connection with a literature search on static friction test instrumentation. The TSP, developed under contract for Goddard Space Flight Center, described the instrumentation the firm desired, however, acquisition of the test device was delayed because of budgeting problems.

<u>Subject</u>	<u>Technology Source</u>
A Midwestern magnetic tape manufacturer	Goddard Space Flight Center Tech Brief 67-10586, "Devices Measures Static Friction of Magnetic Tape"

The firm manufactures magnetic tape products for audio, video, and computer use. An engineer had been asked to conduct a literature search for general information on instruments used to test static friction of magnetic tapes. Knowledge of tape friction under various environmental conditions is important since the producer desires to minimize loss of coating, thus improving tape quality. The company decided that the instrumentation described in the TSP was exactly what was desired.

A West Coast firm which had built prototypes of the measurement device was contacted, but the price was too high. The firm has filed the TSP, but may purchase the static friction measurement device in 1970 if it can be worked into the budget.

LS ad
12/17/69

Case Number 81119065

The Small Business Administration assisted a machine shop operator in obtaining information from NASA which will facilitate the accurate positioning of pieces between machining operations. By using the TSP, developed for Marshall Space Flight Center, the firm expects to realize substantial time savings.

<u>Subject</u>	<u>Technology Source</u>
Kenyon Machine Shop 912 Washington Street San Carlos, California 94070 415-591-0216 Contact Kenneth C. Kenyon Owner-operator	Marshall Space Flight Center Tech Brief 66-10383, "Gear Drive Automatically Indexes Rotary Table"

Kenyon Machine Shop is a small jobbing machine shop which produces flanges, couplings, and valves for vacuum equipment. Kenneth C. Kenyon, owner-operator of the firm, obtained the TSP through the Small Business Administration. Mr. Kenyon hasn't used the information contained in the TSP as yet, but expects to do so when the shop gets a job where it would be applicable.

In the past, a coordinate system has been used to properly locate large pieces for milling or drilling operations. The TSP describes an indexing table with a gear driven mechanism controlled by microswitches. These microswitches arrest the rotational motion of the table at the proper position.

Mr. Kenyon expects to save quite a bit of set up time as compared to the coordinate method. Time saved and potential expenditures will be dependent on the size of the job and the complexity of machining required.

LS ad
11/5/69

Case Number 90121588

A division of a major aerospace firm has evaluated a test article of an improved radiographic image amplifier panel and has requested additional information from the developer.

<u>Subject</u>	<u>Technology Source</u>
Atomics International P.O. Box 309 Canoga Park, California 91304 213-341-1000 Contact A. C. Crawford Program Manager Component Production Operations Division	Marshall Space Flight Center Tech Brief 68-10363, "Improved Radiographic Image Amplifier Panel"

The TSP was prepared by the Electronic Tube Division of Westinghouse Electric Corporation, under contract to NASA's Marshall Space Flight Center. An improved solid state radiographic image amplifier system was developed for the direct viewing of radiographic images as a substitute for fluoroscopy and photofluoroscopy. Electronic radiography is superior to both methods because of increased image brightness and high contrast sensitivity. This system consists of a sandwich type image amplifier and an image retaining panel in cascade. The system combines reasonably short exposure time with a long storage and fast erasure capacity.

Atomics International, a division of North American Rockwell Corporation, fabricates nuclear fuel elements for test and/or research reactors. Recent production has been for the Engineering Test Reactor (ETR) and the Advanced Test Reactor (ATR) operated for the USAEC by the Idaho Nuclear Corporation (INC) near Idaho Falls, Idaho. The fuel elements are made up of nineteen fuel plates which are in turn made of a cermet core consisting of uranium aluminide (UAl_x), B_4C and X8001 aluminum. The core is completely sealed in aluminum which is metallurgically bonded by hot-rolling. The resultant hot-rolled fuel plates are 0.050 to 0.100 inches thick and are machined and formed into these fuel plates to configurations required by the product specification.

Case Number: 90121588 (Cont)

At present, AI is using a conventional fluoroscopic method of radiography for:

1 An inexpensive in-process control procedure to assure that the location of the fuel core within the cladding meets requirements and that the core location holes, which are used for subsequent machining operations, are properly placed

2 An inexpensive process control procedure to locate plates having "flakes" of high density core material outside of the specific core dimensions. This procedure eliminates costly processing of reject fuel plates

Mr. A C Crawford, Program Manager, Component Production, stated that AI has used a test article loaned to them by Westinghouse to inspect the plates prior to machining. He said that the test image amplifier panel used to replace conventional phosphor screens during fluoroscopic inspection provided improved process control since the improved image brightness and detail provided more accurate core location and was more sensitive to detecting "flakes" outside of the permissible fuel core boundary tolerances. Mr. Crawford said AI could use a plate-size amplifier panel in production now but they are not available. AI has requested from Westinghouse information regarding purchase of two four-inch square panels which will be used for the very critical core-plate end interface

Prevention of rejections, earlier detection and correction of conditions leading to scrap and more rapid decision making during fluoroscopic inspection could reduce the ETR and ATR fuel element fabrication cost by a considerable amount. However, the magnitude of any savings are not determinable at this time because specification revisions are required to implement some of them

Mr. Crawford became aware of the TSP through another employee at Atomics International and did not believe that AI, specifically the AI Operations Division of which he is a part, was a regular Regional Dissemination Center subscriber

LS:ad
12/5/69

Case Number. 90425448

A Midwest division of a major automobile manufacturer altered the course of an existing product development program upon receiving information on a new process from NASA. The technology, developed under contract for Marshall Space Flight Center, is an improved process for the epitaxial deposition of silicon on prediffused substrates in the fabrication of integrated circuits. Upon completion of the product development program, it is anticipated that existing processes will be improved and that new products may be developed.

<u>Subject</u>	<u>Technology Source</u>
General Motors Corporation Delco Radio Division P.O. Box 1104 Kokomo, Indiana 46901 317-457-8461 Contact. R. W. Beck Materials Research	Marshall Space Flight Center Tech Brief 68-10390, "Improved Process for Epitaxial Deposition of Silicon on Prediffused Substrates"

The Materials Research Department of General Motors' Delco Radio Division was working on a product development program which involved the deposition of silicon epitaxially on prediffused substrates using silicon tetrachloride as the silicon source. During the development program, several technical problems were being experienced and the results of the program were not satisfactory.

Mr. Beck stated that he learned of the new process, developed by NASA, through a release in Microelectronics Digest, December 1968. In this new process, a layer of silicon from a silane source is first deposited and then the rest of the required silicon layer is deposited from a silicon tetrachloride source. This process, with the combined silicon sources, was incorporated into the product development program at the Delco Radio Division. According to Mr. Beck, since incorporating the silane source into the development program, the company has been able to achieve a quality equal to its existing technology and hope to improve upon this quality.

Although the new process is still in the developmental stage, Mr. Beck stated that if the process proves out it may be quite important. It is

Case Number· 90425448 (Cont)

expected that the new process may also lead to the development of new products in the semiconductor field Mr Beck estimated that the development program will be completed in six months to one year

RLB:bc
12/16/69

Case Number 90526258

The Southwestern division of a major electronics corporation used the "Contamination Control Handbook" in its development of corporate standards. The handbook, developed by the Sandia Corporation under contract to Marshall Space Flight Center, enabled the company to save time in its research efforts.

<u>Subject</u>	<u>Technology Source</u>
General Electric Corporation Computer Division 13430 North Black Canyon Highway Phoenix, Arizona 85023 602-941-2900 Contact H H Green Manager, Industry Standards	Marshall Space Flight Center Tech Brief 68-10392, "Contamination Control Handbook"

The Computer Division of the General Electric Company is in the process of developing corporate standards which may affect the course of future designs, processes and techniques. Included in the standards will be requirements and procedures on contamination control which were developed from the "Contamination Control Handbook" received from NASA's Marshall Space Flight Center.

According to Mr. Green, Manager of Industry Standards for the Division, the handbook proved to be a useful and authoritative source from which the company was able to develop inputs for its corporate standards. Although the handbook was only moderately important to its total task, the company did save time and effort on the segments relating to contamination control. Mr. Green also stated that when the standardization task is completed, G E may use the handbook for classroom instruction on the use of the corporate standards. Although Mr. Green does not regularly receive NASA publications, they are available through the Division's library.

RB ed
12/16/69

Case Number 80814155

The Engineering Division of an Eastern consulting firm will use a NASA document for its work with public utilities and government agencies. The Marshall Space Flight Center TSP on nuclear energy shielding effectiveness has potential use by the firm for future design of nuclear power plants and research reactors.

<u>Subject</u>	<u>Technology Source</u>
Burns & Roe, Incorporated 320 Fulton Hempstead, New York 11550 516-483-8001 Contact Mr. Michael Zizza Deputy Director - Engineering Division	Marshall Space Flight Center Tech Brief 68-10143, "Deep Gamma Ray Pen- etration in Thick Shields"

The data from a TSP on thick shields was found to be useful in the consulting done by Burns & Roe on shielding of nuclear power plants and research reactors for public utilities and government agencies. In planning future projects, Michael Zizza indicated the TSP will be a mandatory reference document, both in determining shield thickness and over-all project design.

The primary value of the TSP to Burns & Roe relates to improved plant design. According to Mr. Zizza, financial savings will be a secondary benefit; he was unable to estimate the exact monetary savings.

Mr. Zizza described this TSP as a complete document containing easily applied information. He stated that the document should be useful to Burns & Roe for a long time, when needed, it will provide a minor, but valuable, contribution to total project design.

HWZ ed
8/28/69

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Case Number 90121730

Dental scientists at an Eastern research institute have used a TSP to develop a computer analysis of tooth X-rays. The computer program technique, developed originally for the NASA Jet Propulsion Laboratory, may provide low income persons with high quality dental care.

<u>Subject</u>	<u>Technology Source</u>
Drexel Institute of Technology 32nd and Chestnut Streets Philadelphia, Pennsylvania 19104 215-387-2400, Ext 594 Contacts Dr Michael Negin Biochemical Engineer Dr Mark Shapiro, DDS Ph D Student, Bio- medical Engineer	Jet Propulsion Laboratory Tech Brief 67-10005, "Digital Computer Process- ing of X-Ray Photo"

Dental researchers working at Drexel Institute of Technology recently began a project involving the computer analysis of tooth X-rays. The project, which may uncover a low cost method for large-scale tooth examinations, was stimulated in part by technology described in a Jet Propulsion Laboratory TSP.

Using the technology described in the TSP, researchers analyze X-ray images with an electromechanical scanner. The light source and the light sensor are fixed and the film is moved at a constant rate, producing a relatively noise-free device that generates highly consistent data. The scanner is interfaced with a LINC-8 computer. An assembly language program was written to sample, digitize, and store the scan data.

Assuming their research is successful, the investigators anticipate the development of large-scale and high quality dental care, particularly adaptable for low income individuals who are unable to afford a sophisticated dental examination.

According to Dr Negin, the TSP saved a considerable number of research hours. He described the document as "complete and exceptionally well cross-annotated."

HWZ ed
10/8/69

Case Number 80815001

The director of research for a Midwestern research center plans to use NASA-generated technology in connection with the physiological study of mentally retarded children. The TSP, developed by Ames Research Center, describes a helmet telemetric system which could have various uses at the center.

<u>Subject</u>	<u>Technology Source</u>
Mental Retardation Developmental Training Center Indiana University Bloomington, Indiana 47405 812-337-6500 Contact: Dr. Milton V. Wisland, Director of Research	Ames Research Center Tech Brief 66-10536, "Helmet System Broadcasts Electroencephalograms of Wearer"

The Mental Retardation Developmental Training Center provides research services for all departments and colleges of Indiana University. Research Director Dr. Milton Wisland said he wants to establish a small residential program at the Center where retarded children can be observed continuously while engaged in recreational and educational experiences. He plans to use the helmet system described in an Ames Research Center TSP to monitor various physiological indicators of anxiety in mentally retarded children.

Dr. Wisland indicated the Center may study an epileptic population in a similar manner. If this is done, the helmet system would be used to obtain electroencephalograms which would then be studied to determine what factors influence the pattern and frequency of epileptic seizures.

LS ss
10/27/69

Case Numbers 90424838, 90424839

An ambulance service in Northern Illinois is interested in marketing a patient monitoring system which transmits from an accident scene to a nearby hospital. The firm is utilizing information reported in two TSP's developed at NASA's Flight Research Center.

<u>Subject</u>	<u>Technology Source</u>
Official Ambulance Service, Incorporated P.O. Box 411 Elgin, Illinois 60120 312-695-5151 Contact Dennis W. Truelsen, President	Flight Research Center Tech Brief 66-10649, "Spray- On Electrodes Enable ECG Monitoring of Physically Active Subjects" Tech Brief 68-10233, "Electrocardiograph Trans- mitted by RF and Telephone Links in Emergency Situations"

Official Ambulance Service provides an emergency service for the Elgin, Illinois, area. Dennis W. Truelsen, Company President, indicated that 90 percent of its deliveries are now made at two area hospitals. He recently proposed to the staffs of both hospitals that a cardiovascular monitoring system be established. The hospital receiving the majority of ambulance deliveries, however, was not receptive to the proposal.

He anticipates that by the end of this year his firm will serve a 50 percent larger area and three additional (though smaller) hospitals. He said that he will resubmit his planned program to the area hospital staffs in December.

Mr. Truelsen learned of the TSP's from AID, a journal of the Ambulance Association of America.

LS ss
9/26/69

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Case Number: 90627305

The Gulf Coast division of a large petroleum company has developed a technique for reclaiming and increasing the life of blocks used in its acetylene production process. A TSP on nondestructive testing of brazed joints, developed for Marshall Space Flight Center, was used to verify the welding techniques employed in the new method

<u>Subject</u>	<u>Technology Source</u>
Tenneco Chemicals, Incorporated Tenneco Hydrocarbon Chemicals Division P O. Box 849 Pasadena, Texas 77501 713-479-3411 Contact: P C Monroe, Jr Mechanical Engineer	Marshall Space Flight Center Tech Brief• 68-10394, "Nondestructive Testing of Rocket Engine Components"

The Hydrocarbon Chemical Division of Tenneco Chemicals produces bulk chemicals and gases at its Pasadena plant. Acetylene is produced at the plant from natural gas by a combustion process. An acetylene block used in the combustion process is exposed to temperature up to 1,000°C. When the block surface is damaged, it is machined down and eventually discarded.

Company engineer P. C. Monroe said that the previously discarded blocks can now be reclaimed. The discarded blocks can be resurfaced by bonding a three inch plate to the block face. The technology involved, described in a Marshall Space Flight Center TSP on nondestructive testing, insures that a vacuum tight bond is developed.

Although the new method is still being tested, it is expected that the reclaimed blocks will soon be used in the production process. The number of blocks used annually is considered proprietary, but Mr. Monroe said that the reclaiming method would yield an estimated \$70,000 savings per year.

There are also other possible uses to which the NASA information may be applied. According to Mr. Monroe, his company uses ultrasonics to test wall thickness on process piping. With the NASA technology, however, it may be possible to more closely establish thickness and

Case Number 90627305 (Cont.)

corrosion rates which would increase the effectiveness of their maintenance program.

RLB·ed
12/30/69

Case Number 91233601

Use of 20,000-watt xenon arc lighting at Kennedy Space Center has indirectly stimulated a new market in agriculture for xenon arc lamps

Subject

Duro-Test Corporation
2321 Kennedy Boulevard
North Bergen, New Jersey 07047
201-867-7000
Contact: Luke Thorington
Director of Engineering

Duro-Test Corporation, the world's largest manufacturer exclusively producing light bulbs, has found a new market for its xenon arc lamps. The discovery of the agricultural market occurred when representatives from the U.S. Department of Agriculture saw the lamps in operation at Cape Kennedy. Originally, the U.S. Army had ordered a number of 30-inch searchlights for use in Vietnam. When the lights were not needed for the war, they were made available to other government agencies. NASA acquired them to improve ground lighting at the launch site and has used the lights for all launches since Apollo 8.

A Department of Agriculture official observed the lights and made inquiries of Duro-Test, thus stimulating company efforts to adapt the lights for agricultural uses. The firm had antecedently performed some research in the agricultural-use area, but the U.S.D.A. inquiry encouraged further work.

Two broad areas are being explored for commercial use. A high-power (20,000-watt) lamp is being modified to use a longer arc, achieving characteristics better suited for agricultural uses. A smaller version is planned for use in projectors. Other uses of the high-power lamp include solar simulation experiments by NASA, and potentially, lighting for stadiums. Xenon lamps presently account for a small portion of the firm's annual sales, but the absolute magnitude is expected to double within one to two years.

The xenon lamp's suitability for agriculture was outlined in an article in Southern Farm Equipment, February 1969. Based on an interview with Mr. Thorington, the article pointed out that as an artificial light

Case Number 91233601 (Cont.)

source, the xenon lamp is unsurpassed in its ability to duplicate natural sunlight as filtered through the earth's atmosphere. Use of these lamps would considerably liberate the farmer from seasonal and climatic constraints, since the lamps provide all the benefits of sunlight, including bactericidal, photosynthetic, and heating qualities. Applications may not be limited to greenhouses. Even animal husbandry may be affected the light-dark cycle of nature affects the reproductive cycle, molting, and autumnal fat deposition of animals, and these can be manipulated by using high-intensity xenon lamps. Breeding practices of domestic animals could be better controlled, as well.

WH ad
12/24/69

Case Number 90627506

A pathologist on the staff of a suburban Chicago hospital is using the "Contamination Control Handbook," developed for Marshall Space Flight Center, as a reference source. He has used the handbook in preparing lectures and articles which he estimates have resulted in nationwide hospital savings of \$100,000 and 1000 man-hours

<u>Subject</u>	<u>Technology Source</u>
Oak Park Hospital	Marshall Space Flight Center
Oak Park, Illinois 60304	
312-848-5700	Tech Brief 68-10392,
Contact Dr James T Hicks	"Contamination Control
Director of Laboratories	Handbook"

As the Director of Laboratories for a suburban Chicago hospital, Dr James Hicks said he is vitally concerned with contamination control in hospital environments. Dr Hicks indicated the contamination control and monitoring techniques NASA has developed are applicable to the solution of hospital contamination problems.

Dr Hicks used the Marshall "Contamination Control Handbook" as a basis for lectures he presented before the National Association of Hospital Central Service Personnel. At Association meetings, he often displays NASA contamination control information. Dr Hicks also used the handbook as a reference for two articles which will appear in Hospital Management Magazine.

Dr Hicks said he believes the increased awareness of his audiences has resulted in better patient care as well as additional protection for hospital workers. He estimated \$100,000 and 1,000 man-hours were saved by hospitals nationwide in the past twelve months with the use of the information. He predicted that savings in the coming year will increase to \$150,000 and 2,000 man-hours.

LS ad
12/15/69

APPENDIX B
Summary Responses to Revised TSP Questionnaire

University of Denver

COLORADO SEMINARY

DENVER RESEARCH INSTITUTE UNIVERSITY PARK, DENVER, COLORADO 80210

QUESTIONS CONCERNING THE NASA TECHNICAL SUPPORT PACKAGE

We would greatly appreciate your help in providing the information requested in this questionnaire. It will be of value to NASA personnel responsible for the Technology Utilization Program. Please answer by checking appropriate boxes.

1 How did you first learn about the availability of the NASA Technical Support Package (TSP) referred to in the cover letter? (N = 846)

7% ☐ From an engineer, scientist, or manager in my own organization

6 ☐ From a librarian in my organization

6 ☐ From a person outside of my organization

23 ☐ Read about this TSP in a trade publication

15 ☐ Read about it in a professional journal

32 ☐ Read a NASA Tech Brief announcing this TSP

11 ☐ Other (specify) _____
100%

2 If you first learned about the TSP in a NASA Tech Brief, how did you acquire the Tech Brief? (N = 272)

51% ☐ Received the Tech Brief directly from NASA

33 ☐ Received the Tech Brief as part of internal distribution within my organization

4 ☐ Received it from someone outside of my organization

12 ☐ Other (specify) _____
100%

3 What was your most important reason for ordering this particular TSP? (N = 844)

56% ☐ To keep abreast of developments in my field(s) of interest

25 ☐ To assist in solving a specific problem or in getting the most up-to-date answer to a particular question

12 ☐ To assist others in my organization in their research and development activities

7 ☐ Other (specify) _____
100%

4 What is your estimate of the number of hours you and other members of your organization spent in reviewing, studying or applying information contained in the TSP you ordered?

Median Time = 1 hour

Mean Time = 6.2 hours

Range Hours = 0.1 - 672.0 hours

5 At which of these levels of scientific or technical development were you working when you requested the TSP? (N = 800)

25% ☐ Acquiring a scientific understanding of nature (basic research)

21 ☐ Demonstrating a new technical capability on a laboratory basis

15 ☐ Applying new technical capability to a full-scale prototype (field trial)

16 ☐ Putting new technology to its first operational use

23 ☐ Other (specify) _____
100%

6 What was your primary use of the information in the TSP? (N = 839)

27% ☐ To help solve a specific technical problem

15 ☐ Passed it along to someone else for possible use

49 ☐ Reviewed and filed it for future reference

2 ☐ Discarded it

7 ☐ Other (specify) _____
100%

7 If you used the TSP for problem solving, how important was it in the solution of that problem? (N = 226)

24% ☐ Not important at all (irrelevant, not applicable)

11 ☐ Slightly important (less than 5% input to problem solution)

33 ☐ Moderately important (about 5% to 14% input to solution)

24 ☐ Quite important (15% to 49% input to solution)

8 ☐ Crucial (50% or greater input to solution)
100%

8 If any beneficial result(s) followed from your use of the TSP, please indicate which one(s) (N = 787, each alternative sums to 100%)

13% ☐ No beneficial results I can think of

65 ☐ Kept me abreast of developments in my field(s) of interest

9 ☐ Stimulated basic and applied research

4 ☐ Developed new process(es) or technique(s)

16 ☐ Improved existing process(es) or technique(s)

2 ☐ Developed new product(s)

5 ☐ Improved existing product(s)

3 ☐ Reduced operating costs

7 ☐ Saved time, manhours

1 ☐ Increased sales

8 ☐ Other (specify) _____

9 If you experienced any problem(s) in trying to use information in the TSP, please indicate which one(s)
(N = 738, each alternative sums to 100%)

- 71% ☐ No difficulties I can think of
 2 ☐ Patent clearance too complicated
 5 ☐ Technology in TSP was not well enough developed for my purposes
 7 ☐ Insufficient information in TSP
 1 ☐ Incorrect information in TSP
 4 ☐ Unusually long delay in obtaining the TSP
 3 ☐ Excessive adaptation costs
 7 ☐ Other (specify) _____

10 Please rate the information contained in the particular TSP you ordered in terms of each of the sets of words below. Make a check mark (✓) in the appropriate space for *each* pair of words [Do not omit any of the items and place only one check mark on any one set of words]
(N = 744)

TSP RATING

important	21	30	36	9	4	unimportant
old	3	8	29	32	28	new
complete	23	32	31	9	5	incomplete
unclear	2	4	22	34	38	clear
unusual	10	18	46	16	10	usual
relevant	27	38	27	6	2	irrelevant
helpful	28	35	23	9	5	unhelpful
superior	11	30	52	5	2	inferior
useless	2	7	25	38	28	useful
poor reproduction	2	3	24	28	43	good reproduction

11 What type of an organization do you work for (check only one)? (N = 839)

- 64% ☐ A manufacturing organization (e.g., electrical machinery, testing instruments, transportation equipment)
 15 ☐ A service organization (e.g., education, retail sales, business consulting, medical services, research)
 7 ☐ A government agency (e.g., Federal, state, local)
 3 ☐ Self-employed
 11 ☐ Other (please specify) _____

100%

12 How large is the organization for which you work?
(N = 835)

- 2% ☐ Self-employed
 3 ☐ 1 to 5 employees
 14 ☐ 6 to 49 employees
 22 ☐ 50 to 499 employees
 11 ☐ 500 to 999 employees
 21 ☐ 1,000 to 4,999 employees
 10 ☐ 5,000 to 9,999 employees
 17 ☐ 10,000 employees or more

100%

13 Please check the appropriate category for your annual income level
(N = 770)

- 21% ☐ Less than \$12,500
 56 ☐ \$12,500 to \$19,999
 23 ☐ \$20,000 or more

100%

14 What is your *primary* job (check only one)? (N = 837)

- 40% ☐ Engineer
 8 ☐ Scientist
 33 ☐ Manager, Supervisor
 4 ☐ Technician
 3 ☐ Librarian
 12 ☐ Other (please specify) _____

100%

15 What is the highest completed level of your formal schooling? (N = 840)

- 17% ☐ Less than a bachelor's degree
 43 ☐ B.A., B.S., or equivalent
 27 ☐ M.A., M.S., or equivalent
 11 ☐ Ph.D. or equivalent
 2 ☐ Other (please specify) _____

100%

16 Do some of your responses contain proprietary information? If yes, please indicate which ones. No information which you identify as proprietary will be associated with you or your organization. (N = 946)

- 8% ☐ Yes (specify) _____

92 ☐ No

100%

Your Name _____ Your Title _____ Today's Date _____

Please return completed questionnaire to

Industrial Economics Division, TSPQ
 Denver Research Institute
 University of Denver
 Denver, Colorado 80210

APPENDIX C
Data Referenced in Section IV

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TABLE C-1. COMPARISONS OF SAMPLE CHARACTERISTICS
WITH TECH BRIEF FILE

